

Concentrations of *Escherichia Coli*
In Surface Water
In the Great Lakes Watersheds
Of Indiana
June –October 2000

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ABSTRACT

Water samples were collected from 92 surface water sites in the Great Lakes Watersheds in Indiana during June through October 2000 and analyzed for concentrations of *Escherichia coli* (*E. coli*) bacteria. Each site was sampled 5 times in a 30-day period, with field parameters measured at each visit.

Tests for *E. coli* concentrations were conducted in a mobile laboratory assembled in a customized cargo van to facilitate the testing of surface water within the constraints of a six-hour holding time. The processing, incubation, and analysis of sample results were performed in the mobile laboratory utilizing the SM-9223- Enzyme-Substrate Method.

Thirty-eight sites were sampled June 12 through July 12, 2000, twenty-five sites were sampled July 24 through August 26, 2000, and twenty-nine sites were sampled September 26 through October 25, 2000. A five-sample geometric mean of concentrations was calculated for each site.

An analysis of data was performed to reduce the number of tests in future surveys that had to be reported as greater than 2420 MPN/100mL (too numerous to count). It was found that results beyond the maximum reporting limit of the method would be significantly reduced by using turbidity levels exceeding 40 NTU as the first criteria for preparing a 10 mL sample volume in addition to the 100 mL sample volume.

Concentrations of *E. coli* in 291 (63.8%) of the 456 surface water samples taken exceeded the Indiana single-sample water quality standard for recreational use of less than 235 per 100 milliliters. Geometric mean concentrations from 71 (77.2%) of the 92 sites exceeded the Indiana water quality standard for recreational use in a five-sample geometric mean by exceeding 125 per 100 milliliters (327 IAC 2-1.5-8 (e)(2)). Samples collected from two sites had *E. coli* concentrations meeting the geometric mean, but exceeding the single sample standard in one sample. Only 18 (19.6%) sites met all water quality standards for recreational use, and included all thirteen lake sites and five stream sites.

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The author would also like to thank Cheryl Silcox, Hydrology Technician, of the Indiana District, United States Geological Survey for her advice on the planning and operation of the mobile laboratory. During 1998,1999, and 2000, her work on *E. coli* monitoring in Indiana set a high standard and will stand as an example of the necessity for creative solutions to new requirements in the field of water quality assessment.

Acronyms and Abbreviations

AIMS	Assessment Information Management System
App.	Appendix
°C	Degrees Centigrade
CFU	Colony forming unit
Fig.	Figure
Geo-Mean	Geometric Mean = n^{th} root of the product of n results
GLI	Great Lakes Initiative
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
ISDH	Indiana State Department of Health
L	Liter
mL	Milliliter
MPN	most probable number
NTU	Nessler Turbidity Units
OWQ	Office of Water Quality
QA/QC	Quality assurance / quality control
QAPP	Quality assurance project plan
RPD	Relative percent difference –the absolute difference in the results between a sample and its duplicate divided by the average of the two
Tbl.	Table
TNTC	Too numerous to Count
USEPA	United States Environmental Protection Agency
UV	ultra-violet light

INTRODUCTION

The Indiana Department of Environmental Management (IDEM) is responsible for monitoring the quality of Indiana's waters. To meet this responsibility, IDEM Office of Water Quality (OWQ) Assessment Branch follows a rotating basin approach described in *Surface Water Quality Monitoring Strategy* (SWQMS)(IDEM1998b). Each year, the Surveys Section of the Assessment Branch conducts multiple surface water quality monitoring programs within targeted watersheds as described in the SWQMS. These programs include the Watershed Monitoring Program, the Fixed Station Monitoring Program, and special projects including Pesticide Monitoring and *E. coli* Monitoring. Statewide *E. coli* Monitoring is an EPA funded 319 grant program and was initiated in the spring of 2000. It provided a mobile laboratory to facilitate the measurement of the bacteria *Escherichia coli* in surface water. That year, 92 surface water sampling sites in the Lake Erie and Lake Michigan watersheds in Indiana were sampled to determine *E. coli* concentrations. The data from these surveys have been analyzed for making comprehensive assessments of the surface water quality for recreational use in order to determine stream standard attainment.

The biological indicator used for this project is *Escherichia coli* (*E. coli*). This parameter is used as an indicator to show the fitness of waterbodies for recreational use/full body contact according to Indiana's surface water quality standards. *E. coli* is thus used to indicate the possible presence of pathogens. A second use for the *E. coli* parameter is the assessment of fecal contamination by point and non-point sources of pollution.

Under rules for the Great Lakes Initiative (GLI), "*E. coli* bacteria, using membrane filter (MF) shall not exceed one hundred twenty five (125) per one hundred (100) milliliters as a geometric mean based on no less than five (5) samples equally spaced over a thirty (30) day period nor exceed two hundred thirty five (235) per one hundred (100) milliliters in any one (1) sample in a thirty (30) day period." (327 IAC 2-1.5-8 (e)(2)) (IDEM 1998).

The rules for both the Great Lakes Initiative area and the state as a whole specify the use of a membrane filter method, which produces a result expressed as colony forming units (CFU). When EPA approved Standard Method 9223-SM Enzyme Substrate Coliform Test (Colilert®)(APHA 1992) for testing drinking water sources, IDEM determined this method should be investigated as a less costly and more accurate method of determining concentrations of *E. coli* in surface water. In 1996 and 1997, the microbiology laboratory of the Indiana State Department of Health conducted parallel testing of surface water samples using Standard Method 9222D, M-Tec Membrane Filter method and the 9223-SM, Colilert Quanti-tray 2000® method. The samples were collected by IDEM Surveys Section. These tests demonstrated no significant difference in the method results. These studies allowed the IDEM commissioner to approve the use of the Colilert method for determining *E. coli* concentrations in surface water (327 IAC2-1.5-10)(IDEM 1998). The concentration of bacteria expressed as most probable number (MPN) is equal to the concentration expressed as CFU.

PURPOSE AND SCOPE

An annual report of the extent to which waters of the State allow recreational activity on and in the water and a description of the nature and extent of non-point pollutants is required by 33 U.S.C.A. 1315(B)(E), 305(b) of the Clean Water Act. The present report documents the findings of three surveys of *E. coli* bacteria levels in water samples collected from selected streams and lakes and provides information for completion of IDEM requirements for the 305(b) report. Many of the sampling sites were located at known recreational areas for boating, canoeing, fishing, swimming, and wading. Other sampling sites were selected to provide data from areas influenced by non-point sources of fecal contamination. Field measurements of water temperature, pH, dissolved oxygen, specific conductivity, and turbidity were also conducted. All data are retained in the Office of Water Quality Assessment Branch Assessment Information Management System (AIMS) database.

DESCRIPTION OF STUDY AREA

The Great Lakes Basins of Indiana are located in the most northern part of the State. Figure 1 shows their position. The study area was divided into three parts for three five-week surveys. The first survey was conducted in the northeast area of the state and was designated the North East Survey. The second survey was conducted in the northwest region of the state and included the streams which flow directly to Lake Michigan. The area and the survey are called the Lake Rim. The third survey was in the north central region and is so named. The St. Joseph River and the Elkhart River watersheds are located in this area. Each survey area is described in a table of hydrological and civil features, a map of the area with sampling sites indicated, and a list describing the location of each site.

The study area includes the tributaries of the Maumee River and Lake Michigan in these counties:

Adams	Lagrange	Lake
Allen	Noble	Kosciusko
Dekalb	LaPorte	Elkhart
Steuben	Porter	St. Joseph

Several lakes were also assessed:

Clear Lake	Cree Lake	Syracuse Lake
Story Lake	Sand Lake	Lake Wawasee
Fish Lake	Miller Lake	Lake George
Long Lake	Dewart Lake	Hamilton Lake
	Shipshewana Lake	

Figure 1 Location of Great Lakes Basins in Indiana



North East Survey

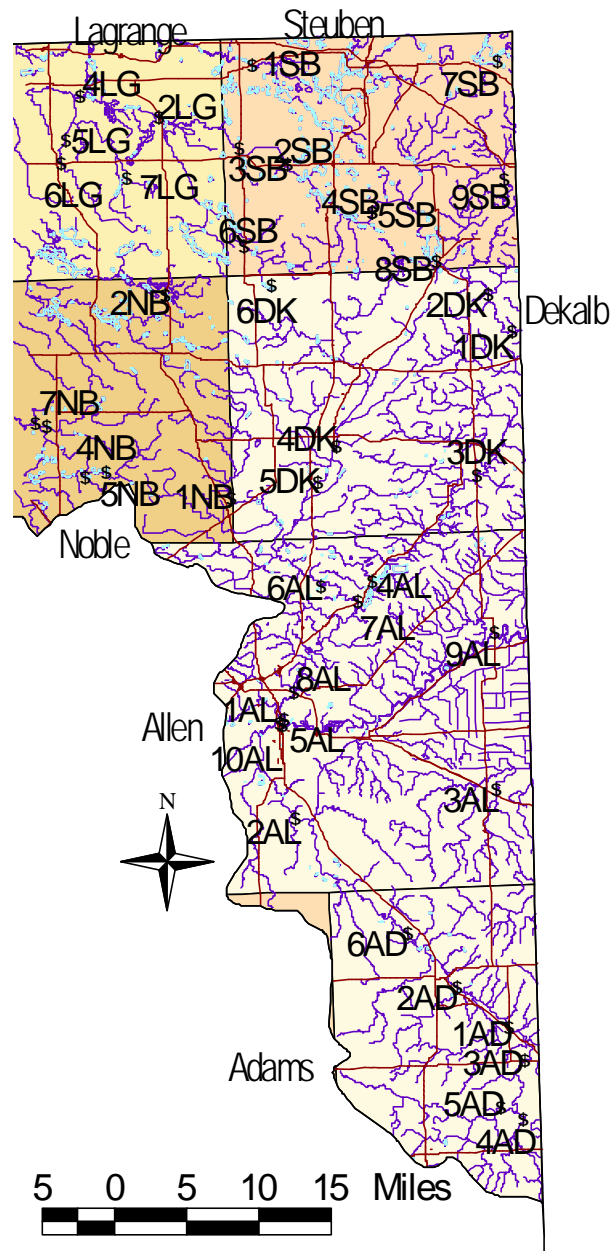
The North East survey was conducted in the Maumee River Watershed. The River drains to the east and flows to Lake Erie in Ohio. The watershed was studied in the first survey. The major waterbodies and civil divisions are described in Table 1. A map illustrating the sampling sites in the North East survey is provided in Figure 2. The abbreviated site names can be referenced in Table 2 with details of location and the Hydrologic Unit Code (HUC). Water quality data for the sites are provided in Appendix A. Data are sorted for each county and listed by stream name and location. *E. Coli* test results, geometric means and field measurements are included for each site. The first survey was conducted in the north east region of Indiana. The region is designated as the Maumee River Watershed.

Table 1 Features of the Maumee River Basin

County	Rivers	Streams	Lakes	Recreational Areas	Towns
Adams	St. Marys R.	Blue Creek		Keokiong Pk.	Pleasant Mills Decatur
Allen	Maumee R. St. Joseph R.	Flatrock Creek Cedar Creek	Cedarville Res.		Ft. Wayne
Dekalb	St. Joseph R.	Cedar Creek Fish Cr.	Story L.	Eckhart Pk.	Auburn Arctic
Steuben		Crooked Cr. Fish Creek Pigeon Cr.	Clear L. Hamilton L.	Pokegon SP	Angola Fremont Hamilton
Lagrange	Pigeon R.	Fish Cr. Fly Cr.	Fish L.	Pigeon R. FWA	Lagrange Mongo
Noble		Little Cedar Cr.			Albion

The Maumee River basin lies within three named physiographic units of northeastern Indiana. The Maumee Lacustrine Plain in east central Allen County is bisected by the river, corresponds with the center of the area, and is marked by a flat terrain of the ancestral Lake Erie. The northern part of the survey area is in the Steuben Morainal Lake Area. Hummocks and uplands characterize this area with numerous depressions occupied by lakes and wetlands. The terrain is greatly varied and localized reflecting the influence of different ice lobes during glaciation. The southern most area of the basin lies in the Tipton Till Plain, the extensive low relief that covers most of central Indiana (IDNR 1996).

Fort Wayne is the largest population center. The convergence of the St. Mary's River from the south and the St. Joseph River from the north form the beginning of the Maumee River, which flows east to Ohio.



**Figure 2 North East Survey Sites
Sampled June-July 2000**

Table 2 Sites Sampled on North East Survey

E Site	Site Name	Stream Name	Description	14-Digit HUC	County Name	Latitude	Longitude
1AD	LES040-0007	St. Mary's River	SR 101 Bridge N of Pleasant Mills	4100004040060	Adams	40 46 45	--84 50 32
2AD	LES040-0008	St. Mary's River	Keokiong Park, Decatur, off Salem Rd	4100004040090	Adams	40 49 13.34	--84 54 29.45
3AD	LES040-0009	Blue Creek	SR 124	4100004040050	Adams	40 44 48.7	--84 49 20.13
4AD	LES040-0010	Little Blue Creek	CR 400 S	4100004040040	Adams	40 41 20.19	--84 49 30.54
5AD	LES040-0011	Blue Creek	Salem Rd S of CR 300 S	4100004040050	Adams	40 42 3.83	--84 51 13.59
6AD	LES050-0004	St. Mary's River	CR 900 N Bridge, E of Winchester Rd.	4100004050040	Adams	40 52 32.93	--84 58 16.98
1AL	LES060-0004	St. Mary's River	Spy Run Bridge, Fort Wayne	4100004060060	Allen	41 5 2	--85 8 9
2AL	LES060-0005	St. Mary's River	Ferguson Rd Bridge W of Winchester Rd	4100004060030	Allen	40 59 28	--85 7 1
3AL	LEA120-0005	Flatrock Creek	Old US 30 bridge, E of 101	4100007120020	Allen	41 0 51.38	--84 51 6.5
4AL	LEJ070-0006	St. Joseph River	DNR boat ramp, or Grabill Rd Bridge	4100003070050	Allen	41 13 22	--85 0 28.13
5AL	LEJ100-0003	St. Joseph River	Tennessee St Bridge, Fort Wayne	4100003100040	Allen	41 5 21	--85 7 45
6AL	LEJ090-0008	Cedar Creek	SR 427, 3 Miles N of SR 1	4100003090090	Allen	41 13 8	--85 4 36
7AL	LEJ090-0011	Cedar Creek	SR 1, S of Cedarville	4100003090090	Allen	41 12 9.63	--85 1 39.1
8AL	LEJ100-0004	St. Joseph River	Canoe Launch Across From IUPUFW	4100003100040	Allen	41 6 55.17	--85 6 59.68
9AL	LEM010-0013	Maumee River	SR 101 Bridge, 3 Miles N of Woodburn	4100005010120	Allen	41 10 11	--84 50 57
10AL	LEM010-0015	Maumee River	Lake Ave Bridge, D/S of Filtration Plant	4100005010010	Allen	41 4 56.4	--85 7 55.27
1DK	LEJ050-0007	Fish Creek	CR 79 Bridge, S of Artic	4100003050060	Dekalb	41 27 54	--84 48 51
2DK	LEJ050-0008	Fish Creek	CR 8	4100003050060	Dekalb	41 30 7.68	--84 50 43.6
3DK	LEJ070-0008	St. Joseph River	Bridge on SR 101, S of Newville	4100003070010	Dekalb	41 19 28.53	--84 52 2.51
4DK	LEJ080-0004	Cedar Creek	Eckhart Park in Auburn; SR 8 to Cedar St	4100003080050	Dekalb	41 21 26.5	--85 3 8.42
5DK	LEJ090-0009	Cedar Creek	Wayne St (CR 427) Bridge, S of Auburn, 56th Rd	4100003090030	Dekalb	41 19 15.89	--85 4 41.47
6DK	LMJ110-0007	Story Lake	DNR Boat Ramp, W of 11th Rd	4050001110090	Dekalb	41 30 54.74	--85 8 7.33
1LG	LMJ090-0007	Fawn River	CR 600 W, N of CR 700 N, E of Scott	4050001090120	Lagrange	41 45 3.03	--85 32 35.92
2LG	LMJ110-0009	Pigeon River	Bridge above Dam at Mongo	4050001110120	Lagrange	41 41 5.32	--85 16 46.48
3LG	LMJ120-0009	Pigeon River	CR 675 at Scott (Game Preserve)	4050001120060	Lagrange	41 44 24	--85 33 25
4LG	LMJ120-0011	Pigeon River	Onterio Bridge, Between CR 325 E, N of 400 N	4050001120010	Lagrange	41 42 24.83	--85 23 1.71
5LG	LMJ120-0012	Fly Creek	CR 150 N, W of CR 200 E	4050001120020	Lagrange	41 39 47	--85 24 22.6
6LG	LMJ120-0015	Fly Creek	US 20, E of LaGrange	4050001120020	Lagrange	41 38 29.23	--85 24 44.01
7LG	LMJ120-0013	Fish Lake	DNR boat ramp, CR 500 E., 1 mile S of US 20.	4050001120030	Lagrange	41 37 31.46	--85 19 29.69
8LG	LMJ120-0014	Shipshawana Lake	DNR boat ramp, 280 N, W of CR 900 W.	4050001120070	Lagrange	41 40 53.63	--85 36 3.46
1SB	LMJ090-0004	Creekooked Creek	Bridge 120, E of 327 at Orland	4050001090050	Steuben	41 44 3.8	--85 9 15
2SB	LMJ110-0006	Pigeon Creek	Near Angola Airport on US 20, W of CR 600 W	4050001110070	Steuben	41 38 4.07	--85 6 34.27
3SB	LMJ110-0010	Pigeon River	Boat Ramp on 327, 1/4 mile N of US 20	4050001110080	Steuben	41 39 4.92	--85 10 27.43
4SB	LMJ110-0012	Pigeon Creek	Bill Deller Rd	4050001110040	Steuben	41 35 9.32	--84 59 50.44
5SB	LMJ110-0014	Pigeon Creek	CR 400 S, E of Old Hwy 27	4050001110040	Steuben	41 35 9.3	--84 59 50.44
6SB	LMJ110-0011	Turkey Creek	Bridge on 327, at Turkey Cr Rd	4050001110100	Steuben	41 33 20.93	--85 10 11.4
7SB	LEJ020-0001	Clear Lake	Public Beach, East end	4100003020010	Steuben	41 43 53.09	--84 49 28.04
8SB	LEJ050-0009	Hamilton Lake	Public Beach, Lake Outlet	4100003050050	Steuben	41 32 10	--84 54 44
9SB	LEJ050-0010	Fish Creek	CR 200 S, East of Metz	4100003050030	Steuben	41 36 55.6	--84 49 12.03

Lake Rim Survey

The Lake Rim Survey was conducted in the Lake Michigan Rim area in the extreme northwestern part of the Northern Lake and Moraine region. The watershed was studied in the second survey. The major waterbodies and civil divisions are described in Table 3. A map illustrating the sampling sites in the Lake Rim survey is provided in Figure 3. The abbreviated site names can be referenced in Table 4 with details of location and the Hydrologic Unit Code (HUC). Water quality data for the sites are provided in Appendix A. Data are sorted for each county and listed by stream name and location. *E. Coli* test results, geometric means and field measurements are included for each site.

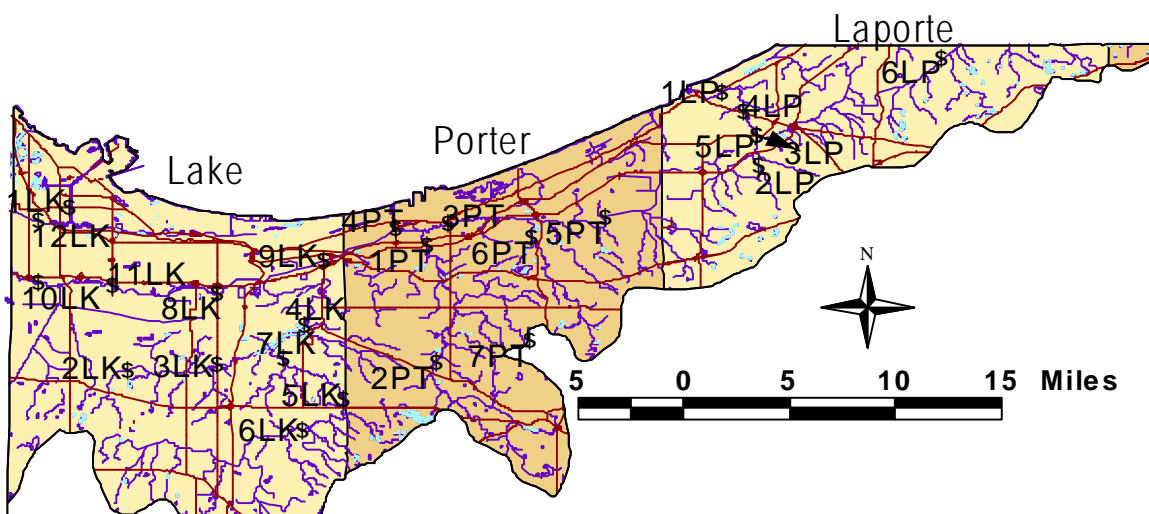


Figure 3 Lake Rim Survey Sites Sampled July-August 2000

It includes all of the Calumet Lacustrine Plain, which has little natural terrain due to urbanization, but was originally characterized by dune capped ridges up to 180 feet higher than the Lake Michigan shore. The basin also includes the northern part of the Valparaiso Morainal Plain, which is comprised of three end moraines marking the limit of glacial advancement in the late Wisconsin glacial period, 10,000 years ago (IDNR 1994). The area is the locale of many heavy industrial-manufacturing plants, most notably, steel mills and chemical plants. There are shipping centers and marinas along the shoreline, with bathing beaches in between. The sampling sites were selected in co-operation with the Taskforce on *E. coli*, which operates out of the Northwest Regional Office of IDEM located in Gary, Indiana.

Table 3 Features of the Lake Michigan Rim Basin

County	Rivers	Streams	Lakes	Recreational Areas	Towns
Lake	Grand Calumet R. Little Calumet R. Deep R.	Turkey Creek	Lake George	Deep River Co. Pk. Columbia Park	Gary Hobart East Chicago
LaPorte	Galena R.	Trail Creek		Galena WCA	Michigan City
Porter	Little Calumet R.	Salt Creek Coffee Cr.	Long Lake	Indiana Dunes St. Pk.	Portage Chesterton

Table 4 Sites Sampled on Lake Rim Survey

ESite	Site Name	Stream Name	Description	14-Digit HUC	CtyName	Latitude	Longitude
1LK	LMG020-0016	Indiana Harbor Canal	Bridge on SR 312, Park on side street, E of Water Tower	4040001020010	Lake	41 37 45.57	--87 28 15.63
2LK	LMG030-0006	Turkey Creek	N of New Elliot, Pull Over on W Side of St, Narrow Bridge	4040001030010	Lake	41 30 0	--87 25 4
3LK	LMG030-0007	Turkey Creek	SR 53 Broadway, S of 61st St	4040001030020	Lake	41 30 16.27	--87 20 9.35
4LK	LMG030-0008	Deep River	Festival Park in Hobart, Lake George	4040001030060	Lake	41 32 7.43	--87 15 23.13
5LK	LMG030-0009	Deep River	Deep River County Park, Ped Bridge	4040001030060	Lake	41 28 36.49	--87 13 16.37
6LK	LMG030-0010	Deep River	Grand Blvd bridge, South of US 30, 2 miles	4040001030050	Lake	41 27 8.71	--87 15 30.21
7LK	LMG030-0011	Deep River	61st Ave, W SR 51, South of Hobart	4040001030060	Lake	41 30 30.56	--87 16 34.73
8LK	LMG040-0004	Little Calumet	SR 53 bridge, S of Exit 10 I-80	4040001040020	Lake	41 33 39.42	--87 20 11.65
9LK	LMG040-0005	Burns Ditch	SR 51 bridge, north of I-94, Exit 15	4040001040030	Lake	41 35 13.37	--87 14 24.62
10LK	UMC030-0005	Little Calumet River	Columbia Dr Bridge, S of Riverside Dr	7120003030060	Lake	41 34 8.8	--87 30 0.33
11LK	UMC030-0007	Little Calumet River	SR 912 S Bound, S of I80-95 Exit 5	7120003030050	Lake	41 33 59.5	--87 25 57.2
12LK	UMC050-0004	Grand Calumet River	Bridge on Columbia St,@ Columbia Pk	7120003050010	Lake	41 37 7.12	--87 30 0
1LP	LMG070-0005	Trail Creek	Michigan City, Liberty St Bridge	4040001070030	Laporte	41 43 21	--86 52 33
2LP	LMG070-0010	Trail Creek	Woziniak Rd, S of 400 N	4040001070020	Laporte	41 39 47.92	--86 50 34.34
3LP	LMG070-0011	Trail Creek	Old US 20 Bridge, S of US 20, E of Johnson Rd	4040001070030	Laporte	41 41 15	--86 50 39.97
4LP	LMG070-0017	Trail Creek	US 35	4040001070030	Laporte	41 42 19.48	--86 51 22.65
5LP	LMG070-0018	Trail Creek	US 20	4040001070030	Laporte	41 41 14.89	--86 50 41.24
6LP	LMG100-0004	Galena River	Bridge on 125E, N of 900N	4040001100050	Laporte	41 44 52.8	--86 40 30.48
1PT	LMG050-0006	Salt Creek	US 20 Bridge, Portage	4040001050050	Porter	41 35 59	--87 8 47
2PT	LMG050-0009	Salt Creek	500 N Bridge, E of 450 W, N of SR130	4040001050030	Porter	41 30 26	--87 8 14.52
3PT	LMG060-0008	E Br Little Calumet River	SR 149, S of US Hwy 12, NW of Porter	4040001060040	Porter	41 37 1	--87 7 34
4PT	LMG060-0009	E Br Little Calumet River	SaltCreek Landing,SR 249 Bridge, North of I-94 Exit 19	4040001060040	Porter	41 36 44.24	--87 10 24.41
5PT	LMG060-0011	Little Calumet River	Bridge on CR 1300N, W of CR 450E	4040001060020	Porter	41 37 20.76	--86 58 59.58
6PT	LMG060-0025	Coffee Creek	Morgan Ave bridge next to park	4040001060030	Porter	41 36 24.29	--87 3 1.44
7PT	UMK090-0026	Long Lake	Public Access, Long Lake Rd - Boat Ramp - DNR	7120001090060	Porter	41 31 28.81	--87 3 6.85

North Central Survey

The North Central Survey was conducted in the St. Joseph River basin area in the The watershed was studied in the second survey. The major waterbodies and civil divisions are described in Table 5. A map illustrating the sampling sites in the survey is provided in Figure 4. The abbreviated site names can be referenced in Table 6 with details of location and the Hydrologic Unit Code (HUC). Water quality data for the sites are provided in Appendix A. Data are sorted for each county and listed by stream name and location. *E. Coli* test results, geometric means and field measurements are included for each site.

The St. Joseph River basin is characterized by a variety of features including rugged moraines and level till plains interspersed among the channels and basins formed as the glaciers of the Ice Age advanced then melted. The area has many lakes and wetlands. Urban development has expanded from the city centers founded on the St. Joseph River. Much of the land is in agriculture. The area attracts tourism and development around the lakes. Lake Wawasee is the largest natural lake in Indiana (IDNR 1987).

Figure 4 North Central Survey Sites Sampled September- October 2000

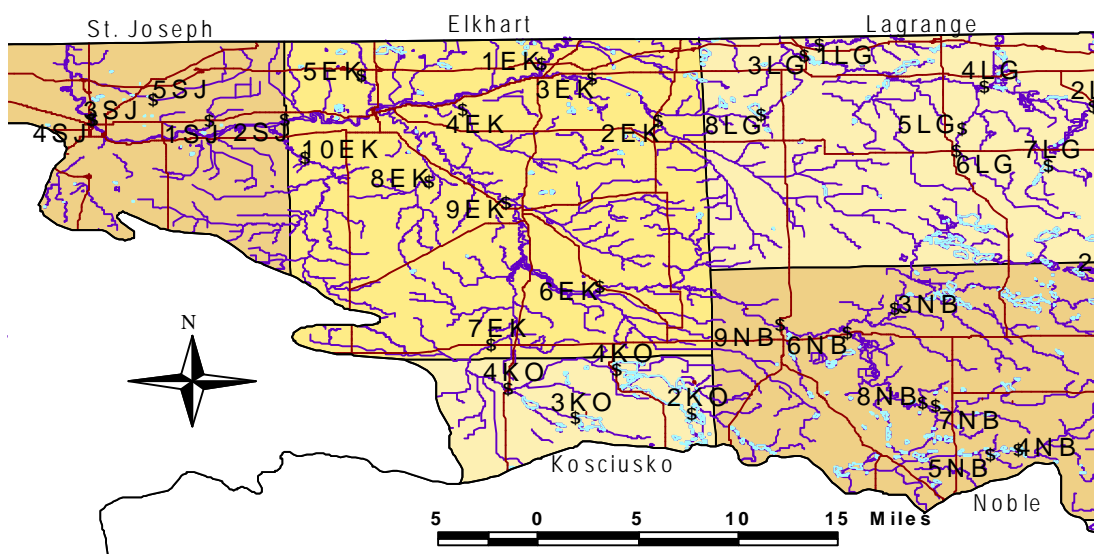


Table 5 Features of the St. Joseph River Basin

County	Rivers	Streams	Lakes	Recreational Areas	Towns
Elkhart	St. Joseph R. Elkhart R. Little Elkhart R. Christiana Cr.	Baugo Cr. Yellow Cr. Turkey Cr. Pine Cr.	Wawasee	Bonnyville Mill River Bend Pk.	Elkhart Goshen Middlebury
Kosciusko		Turkey Cr.	Syracuse Dewart		Syracuse Milford
Lagrange	Fawn R. Pigeon R.		Shipshewana		
Noble	North Br. Elkhart R. South Br. Elkhart R.	Croft Ditch.	Sand Lake Miller Lake	Chain o' Lakes SP	Ligonier Albion
St. Joseph	St. Joseph R.	Willow Cr. Juday Cr.	Fish Lake	Pigeon R. FWA	Lagrange Mongo

Table 6 Sites Sampled on North Central Survey

ESite	Site Name	Stream Name	Description	14-Digit HUC	CtyName	Latitude	Longitude
1SJ	LMJ240-0005	Willow Creek	Jefferson St in Powerline Easement,	4050001240020	St. Joseph	41 40 44.94	--86 7 58.37
2SJ	LMJ240-0007	St. Joseph River	SR 219 Osceola	4050001240010	St. Joseph	41 40 48	--86 3 40
3SJ	LMJ240-0018	St. Joseph River	End of race, End of Madison St. pier	4050001240040	St. Joseph	41 40 54.29	--86 14 50.91
4SJ	LMJ240-0019	St. Joseph River	Riverside Dr At End of Race	4050001240040	St. Joseph	41 40 51.7	--86 14 48.22
5SJ	LMJ240-0021	Juday Creek	Grape Rd, S of Douglas	4050001240050	St. Joseph	41 42 5.19	--86 11 14.2
1EK	LMJ130-0001	St. Joseph River	US 80/90	4050001130030	Elkhart	41 44 6.2	--85 48 39.3
2EK	LMJ140-0005	Little Elkhart River	River Bend Pk, Warren St (CR16) E of SR 13	4050001140060	Elkhart	41 40 30.75	--85 42 0.46
3EK	LMJ140-0013	Little Elkhart River	Bonneville Mill Park, CR 33, S of 120, Foot Bridge Over Creek	4050001140070	Elkhart	41 43 10.1	--85 45 47.76
4EK	LMJ150-0007	Pine Creek	CR 17, S of 120	4050001150030	Elkhart	41 41 22.51	--85 53 17.6
5EK	LMJ160-0002	Christiana Creek	CR 6, W of SR 19, N of Elkhart	4050001160060	Elkhart	41 43 27.45	--85 59 6.28
6EK	LMJ190-0006	Elkhart River	SR 33 Near Benton	4050001190070	Elkhart	41 30 28	--85 45 34
7EK	LMJ200-0014	Turkey Creek	SR 6 Bridge, W of SR 15, N of Milford	4050001200080	Elkhart	41 26 59.3	--85 51 54.54
8EK	LMJ210-0002	Yellow Creek	CR 13	4050001210060	Elkhart	41 37 1.26	--85 55 22.45
9EK	LMJ210-0007	Elkhart River	At Goshen, River Ave Bridge Gage #04100500	4050001210010	Elkhart	41 35 36	--85 50 55
10EK	LMJ230-0005	Baugo Creek	CR 1, N of CR 24	4050001230040	Elkhart	41 38 29.95	--86 2 31.31
1NB	LEJ090-0010	Little Cedar Creek	CR 300 S, E of SR 3	4100003090050	Noble	41 18 26.08	--85 11 39.66
2NB	LMJ170-0010	Cree Lake	DNR boat ramp. E Side of SR 3	4050001170010	Noble	41 30 33	--85 16 34.5
3NB	LMJ170-0007	N Br Elkhart River	At Cosperville, CR 900 N	4050001170080	Noble	41 28 54	--85 28 32
4NB	LMJ180-0006	Miller Lake Chain O Lakes SP	Entry Gate first right to Boat ramps, Miller on left	4050001180010	Noble	41 20 11.38	--85 21 37.07
5NB	LMJ180-0007	Sand Lake Chain O Lakes SP	Swimming Beach in Park	4050001180010	Noble	41 19 51.1	--85 23 13.86
6NB	LMJ180-0009	S Br Elkhart River	DNR Boat Ramp, SR 6, West of CR 450 W	4050001180060	Noble	41 27 28.66	--85 31 22.42
7NB	LMJ180-0010	Croft Ditch	Bridge downstream of Albion MWTP	4050001180040	Noble	41 22 57.69	--85 26 17.69
8NB	LMJ180-0011	S Br Elkhart River	East of Albion River Road bridge	4050001180050	Noble	41 23 9.54	--85 27 6.8
9NB	LMJ190-0008	Elkhart River	SR 5 Bridge in Ligonier	4050001190020	Noble	41 28 0.47	--85 35 15.36
1KO	LMJ200-0005	Turkey Creek	Public Fishing Site, E of SR 13 in Syracuse	4050001200020	Kosciusko	41 25 22.1	--85 40 26.58
2KO	LMJ200-0006	Lake Wawasee	CR1000 N, DNR Fishing Pier	4050001200020	Kosciusko	41 22 37.42	--85 44 40.31
3KO	LMJ200-0007	Dewart Lake	DNR boat Ramp, E of CR 300 E	4050001200040	Kosciusko	41 22 27.02	--85 47 6.86
4KO	LMJ200-0013	Turkey Creek	SR15 Bridge in Milford	4050001200030	Kosciusko	41 24 18	--85 51 0.2

***E. COLI* SURVEY METHODS**

Selection of Sampling Sites

A preliminary list of 100 sites was developed using information on recreational waters compiled by the Surveys Section from a 1987 statewide survey of IDNR Conservation Officers and Local Health Departments. County Health Departments in the study area were contacted by telephone to obtain up-to-date recreational information and current local areas of concern. This list of sites was pre-surveyed to determine safe access, and recreational suitability. The list was reviewed with the *E. coli* Task Force committees to reduce duplication of effort and to increase coverage in the Lake Michigan Tributaries. The sampling sites were then established during the first week of each five-week survey, considering travel time to and from the survey area, time constraints on work hours, and efficient routes of travel from site to site. The three surveys attempted to include all parts of each major watershed in the same five week sampling event. When practical, the sampling sites were at bridges, enabling staff to collect water samples from the center of flow.

Collection of Water Samples and Field Data

Grab samples of surface water were collected from the stream at the visual center of flow using a clean 6-L stainless steel bucket, rinsed thoroughly with the surface water being sampled. The bucket was lowered from the downstream side of the bridge over a stream. If the sampling location was in a lake, the sample was taken off shore, at the end of a pier or by wading to a depth of about four feet. The bucket was filled, rinsed, emptied away from the point of collection and then filled again. Then either 100 mL or 110 mL of water was collected. The sterile 120 mL plastic sample bottle was lowered into the bucket with a talc-free latex gloved hand in such a way as to fill it in the center of the sample, not off the top, nor scraping the bottom. A properly collected water sample would not have visible debris in it. The AIMS sample number, site name, the date, and time were recorded on the label and field sheet. The Lab sample number was written in the lid of the bottle. The water sample was immediately stored in a small cooler with ice or ice packs to cool it to less than 10°C.

The remainder of the water sample was used for field measurements of temperature, dissolved oxygen, pH, specific conductivity, and turbidity using a Hydro-lab[®] multi-parameter instrument. A field data sheet was completed at each site. Stream clarity, canopy, and flow characteristics were observed and recorded. Weather conditions were also recorded on the field data sheet.

***E. Coli* Testing Methods and Materials**

The Statewide *E. coli* Monitoring Grant provided a mobile laboratory to facilitate *E. coli* testing by eliminating the necessity of transporting water samples to distant contract laboratories within a six-hour holding time. The mobile laboratory was funded by a Section 319, Federal Clean Water Act grant and it was used for the first time in these surveys. Use of Method 9223-SM Enzyme Substrate Coliform Test is approved by the IDEM commissioner for the evaluation of waters of the State for full body contact recreational uses.

The mobile laboratory is a raised roof cargo van converted to provide rear door access for the collection of water samples and field data and to provide adequate workspace for the preparation,

incubation, and analysis of *E. coli* tests. The interior conversion provided storage of water samples, supplies, and all equipment for Colilert® testing.

One or two sample volumes were used to obtain at least one test result that represents the MPN between 1 and 24,000 bacteria per 100 mL. Each water sample was evaluated at the sampling site to determine the dilution volumes required, then the container was marked respective of the determined dilutions. In these cases, 110 mL of sample was collected. 100 mL water samples were set for normal stream waters with results accurate from < 1 to 2419 MPN. If the water samples were muddy or gray, a dilution was prepared by pipetting 10 mL sample in 90 mL of sterile dilution water, for results of <10 to 24,190 MPN. Both 100 mL and 10 mL of samples were prepared in these cases.

A laptop computer and Access data base were used to record data as it was obtained each day. This facilitated data entry and helped in the development of data portability into AIMS.

The testing procedure, which was developed as part of the work plan for this project, is documented in *Guidelines for the Operation of the Mobile E. coli Laboratory*, as one of the sections in the *Survey Section Field Procedure Manual* (Beckman 2000). A summary explanation of procedures is provided here.

Each testing session was discreet. All sampling equipment was stored at the end of each sampling route. Two analysts worked in the van to complete the preparation of samples for incubation so that efficiency of motion was established.

The workbench and shelf above the bench were sanitized with Conflict Brand Disinfectant before sample preparation. The water samples were removed from the cooler and arranged in order on a shelf above the lab bench. Dilution blanks were labeled and inserted between samples as needed. The exact number of Quanti-trays® were unpacked, and labeled with Lab sample numbers and dilution volumes, then stacked in order. The exact number of IDEXX media packets and pipettes needed were unpacked. Typically, between 10 and 15 surface water samples plus the dilutions, the duplicates and the blanks were processed at one time. By being exact at this step, analysts would not get confused as each step was completed. All the paperwork was prepared as the water samples were warming to room temperature. The bench sheet(s) listed analysis set number, date, and time of preparation and analyst's initials in the header. For each sample and sample dilution, the data base control number, the sample volumes used, and the assigned lab sample number were listed in order on the benchsheet. The exact same number of entries on the bench sheet as water samples, dilutions, QC water samples, and all corresponding Quanti-trays was verified. A quality-control worksheet was filled out at this time, with lot numbers of the supplies, QC test results on the media, control numbers for duplicate water samples, field blanks and equipment blanks.

At this point, the IDEXX Quanti-Tray® model 2X sealer was placed on the workbench and turned on to heat to operating temperature.

Samples were processed by adding ready-to-use Colilert® media substrate to the sample containers. Aseptic technique was used in all steps of preparation. One analyst worked with water samples that did not need dilutions, and the other one worked with the samples to be diluted. Shaking each water sample vigorously about 25 times at each step broke up any clumps of bacteria, a crucial step when using MPN methods. If making a dilution, 10 mL of water was pipetted into a dilution blank prepared with 90mL of sterile water in a sterile sample bottle. The

media was added to the sample bottle and the sample was shaken again. The water samples were placed back on the shelf until all samples had media added.

When the sealer was heated to operating temperature, the samples were shaken again and poured into the trays, insuring the tray had the corresponding lab sample number. The second analyst took the tray to insert into the IDEXX Quanti-tray® sealer. First, any air spaces trapped in the small wells were knocked out by tapping the front of the tray. By pressing a filled tray, wells down, gently and completely into the insert, and then properly inserting the tray on the input shelf of the sealer, the tray was sealed and ejected in about 15 seconds.

When all preparations were completed, the trays were placed in the incubator for 24 to 28 hours at 35°C +/- 0.5°. The time was noted on the bench sheet, the sample logbook, and the QC worksheet. All sample vessels and other trash were placed in biohazard bags. The workspace was again disinfected.

The incubators were Thermolyne Type 42300 series 423 120 V gravity-convection units supplied by IDEXX. They were size-proportioned to accept the trays inserted on their side edges allowing air to flow vertically while the incubator was loaded. Sample trays were preheated in an empty unit, then transferred to a partially filled unit, or left in the original unit depending on the need for an empty incubator. Cold samples were never added to a partially filled incubator. The temperature of the units was monitored with minimum/maximum thermometers that were reset when the heated chamber had recovered to at least 34.5°C. Due to the difficulty of maintaining a constant ambient temperature in the van, these incubators were frequently relocated to hotel rooms or the Surveys Section workroom overnight. When outdoor temperatures exceeded 85° F, arrangements were made to keep the incubators in the hotel rooms all day, returning to the hotel for analysis of the samples. The most challenging aspect of the mobile laboratory methodology was the maintenance of proper incubator temperatures.

After 24 hours, color and fluorescence developed in the media. This allowed the analysts to count positive wells in the tray for both total coliform (yellow) and *E. coli* (fluorescent- blue) and derive a MPN from charts provided by the manufacturer.

The test analysis was conducted by two analysts after 24 to 28 hours of incubation. This is the preferred method, so that two counts can be checked against one another. When the mobile laboratory was parked, the bench space was cleared and disinfected. The sample set was removed from the incubator and stacked in the order matching the bench sheet. The time was noted on the QC sheet and bench sheet. The UV light was turned on and set aside to let it warm up for a few minutes. The yellow wells were counted first to obtain total coliform results. The large yellow wells, including the one oversized well, were counted and recorded. Then the small yellow wells were counted and recorded. The number of large wells and small wells are cross-referenced on the MPN chart and the number corresponding to the well counts was recorded as total coliform. The trays were analyzed for total coliform and re-stacked in order. Using the UV light and sunglasses, the florescent blue wells were counted and recorded as *E. coli*. When finished, *E. coli* results were recorded on the bench sheets, in the sample log, and in the database. Biohazard bags were used for Quanti-tray disposal.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Quality control procedures were followed for collecting and testing water samples. These procedures included frequent calibration of equipment as well as collection of additional water samples for quality control. Analysis of quality control samples provides information about the potential for sample contamination during collection and preparation of samples and quantifies natural variability in the *E. coli* concentrations.

Quality Assurance for the Collection of Field Data

The Hydro-lab[®] multi-parameter water quality meter was calibrated each Monday using laboratory standards. The buffer solutions used to calibrate the Hydro-lab[®] meter were prepared in the Surveys Section calibration room. Conductivity standards of 718 µg/L were prepared from 3000-ppm NaCl solutions from Myron L. Company. Standard buffer solutions for pH 7 and pH 10 were prepared from Hydriion Buffer Chemvelopes. Turbidity standards of 40 NTU were prepared from Formazin standard solution of 4000 NTU. All standards were prepared at least once per month, usually more often. Dissolved oxygen calibration was performed in the Surveys Section calibration room using air calibration techniques recommended by the manufacturer. Current atmospheric pressure readings were obtained from the Indianapolis Airport National Weather Service and adjusted for elevation differences from sea level. Results and parameter drift were recorded and maintained in the Hydro-lab[®] maintenance notebook (Beckman 2000).

In the field, the instrument was checked each morning at the first site by comparing the results of the Hydro-lab field measurements of pH and dissolved oxygen with the results of a pH measurement using a portable pH meter and the dissolved oxygen measurement using the Winkler titration method for dissolved oxygen. Results of these calibration checks were required to be within 0.2 mg/L of each other. The same Hydro-lab[®] unit (Unit 10) was used throughout these surveys and never failed to meet these calibration checks. Reagents for the dissolved oxygen test were supplied on a regular basis by the Indiana State Department of Health Laboratories.

Quality Assurance for Laboratory Procedures

The expendable supplies from the IDEXX Corporation were quality checked whenever new cases of media, sample vessels, or Quanti-trays were opened. All were inspected for auto-fluorescence. Media was checked for performance using agar slant cultures prepared by the Indiana State Department of Health (ISDH) Laboratories to inoculate sterile blanks. Absence of coliform bacteria was tested with *Pneumonia aeruginosa*; presence of coliform that is not *E. coli* was tested with *Klebsiella pseudomonas*; and presence of *E. coli* was tested with an *E. coli* culture. Results of these tests on each batch of media were maintained on each lab batch's QA/QC work sheet.

Incubators were checked and calibrated daily using interior glass thermometers and the digital temperature monitors. Incubator temperature logs were maintained with readings mornings and evenings when they contain samples. Temperature logs for the interior of the mobile laboratory and the sample coolers were maintained with readings recorded prior to laboratory work sessions. Power supplies for the incubators were monitored with a voltmeter on the auxiliary battery and converter, and an audio alarm to warn of low power.

Quality Control Procedures

Quality control samples consisted of a field blank, equipment blank, and at least one duplicate sample per lab batch.

Field blanks consisted of 100 mL of sterile de-ionized water in a sterile sample vessel. The vessel was filled at the first site each day from the water carboy used to rinse equipment in the field. The field blanks were stored with all the samples collected that day. Equipment blanks were prepared in the same way at the last site of the day's sampling and tested as the final sample of each batch. Dilution blanks were prepared in the Surveys Section Calibration Room using the same sterile DI water used to fill the carboy. The test results were recorded on each lab batch's QA/QC work sheet.

Analyses of duplicate water samples measure the natural variance of bacteriological counts for this method. Duplicate samples were collected sequentially with the environmental samples. The duplicates were tested in the same manner as the environmental samples. Duplicates were collected at the rate of one per 10 samples, with a minimum of one duplicate sample per sample set. Relative percent difference (RPD) of duplicate samples were calculated and recorded on the lab batch's QA/QC work sheet.

Statistical analysis of 46 RPD values demonstrates that the natural variability is typically between 20% and 30%. Figure 4 shows the number of occurrences in each 2% increment of RPD values. Table 7 shows the values for the mean, median, and standard deviation of the tests conducted in 2000.

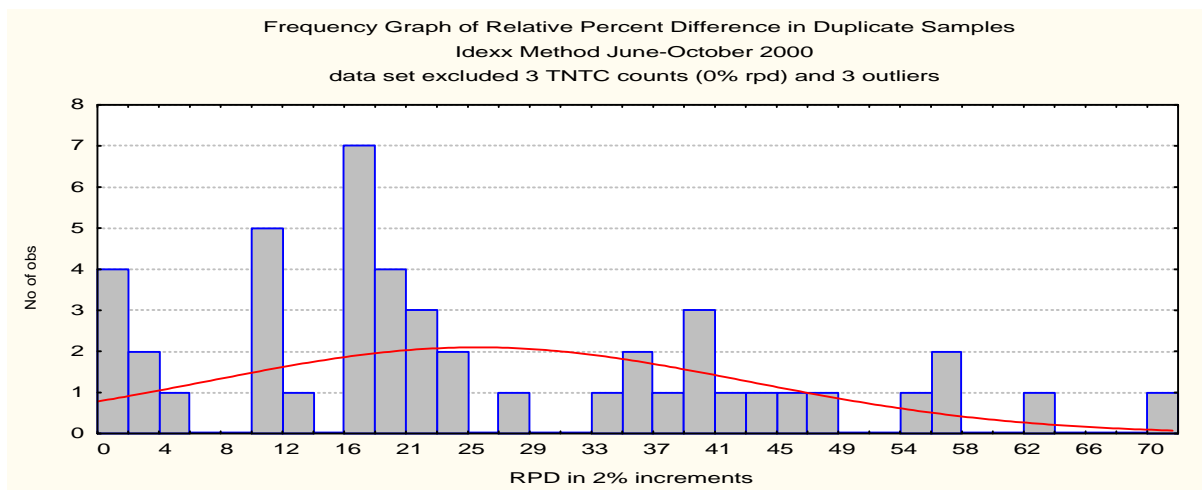


Figure 5 Frequency Graph of Duplicate Samples

Table 7 Relative Percent Difference in Duplicate Samples

	Valid N	Mean	Confid. -90.000%	Confid. +90.000%	Median	Variance	Std. Dev.	Standard Error
RPD	46.000	25.331	20.873	29.788	19.695	324.011	18.000	2.654

A laboratory report for each batch of samples was submitted to the Chemistry and Toxicology Section for review of precision, accuracy, and completeness to establish a Data Quality Assessment. Each laboratory report consisted of the Chain of Custody sheets, the Field Data Sheets, completed bench sheets, and Quality Control Reports for all the tests performed in a weekly survey. The quality control officer, Kris Kehoe, examined the reports and subsequently documented the findings, including results and QC flags in a QA/QC report. These 15 reports have been listed as IDEM 2000a-b and IDEMa-l in the citation section at the end of this report. All data received a Data Quality Assessment (DQA) rating of 3 as defined by the Assessment Branch Quality Assurance Project Plan (QAPP)(Bowren and GhiasUdden 1999).

RESULTS AND DISCUSSION

Staff completed 15 weeks of surveying during the recreational season of 2000. All of the resulting water quality data are in the Assessment Branch Information Management System (AIMS) data base. Water quality data for the sites are provided in Appendix A. Data are sorted for each county and listed by stream name and location. *E. Coli* test results, geometric means and field measurements are included for each site.

Using *E. coli* data from each site, a geometric mean was calculated. The data were subsequently used to describe the recreational use attainment of stream segments in the 2002 Comprehensive State Water Quality Assessment (305(b) report) required by the Clean Water Act. The 305(b) report is prepared using many different types of surface water quality data to determine use attainment for aquatic life and fish consumption. *E. coli* concentration is the only parameter used to establish use attainment for recreational waters. Use attainment is described as supportive, partially supportive, or non-supportive of each of the three uses. A stream is assessed as fully supportive of recreational use if the geometric mean is not greater than 125 MPN/ 100 mL and non-supportive if the geometric mean is greater than 125 MPN/ 100 mL.

In addition to the 305(b) report, a prioritized listing of waterbodies that do not meet use attainment, the 303(d) list of impaired waterbodies, must be prepared as required by the Clean Water Act. Priority ranking must take into account the severity of the pollution and the uses to be made of the water (USEPA 1991). By classifying the severity of the impairment to recreational use, the assessments can be used by the IDEM Office of Water Quality Planning Branch to prioritize the 303(d) list and the funding of various watershed projects and TMDL studies. The sites were classified as highly impaired if the geometric mean of the water samples taken exceeded 1000 *E. coli* per 100 mL. The sites were classified as moderately impaired if the geometric mean was between 600 and 1000 *E. coli* per 100 mL and slightly impaired if the geometric mean was less than 600 *E. coli* per 100 mL. These categories were established by the IDEM 305(b) coordinator for the severity assessments. The test results of each survey have been charted to illustrate the ranges of the *E. coli* concentrations found at each site. The sites in the same watershed have been grouped on the charts. The sites in each watershed can be compared to each other because the samples were all taken on the same day.

Results of North East Survey

During the North East Survey, conducted June 12, 2000 to July 12, 2000, 56 (29.5%) samples of 190 taken met the one-day recreational standard of less than 235 *E. coli* per 100 mL. Of the 38 sites assessed only 7 (18.4%) met the five-sample geometric mean standard and were fully supporting of recreational activity. Table 8 summarizes the water quality conditions of the sites in the North East survey. The five lakes in the North East survey had geometric means ranging from 2 *E. coli* per 100 mL at Clear Lake to 42 *E. coli* per 100 mL at Fish Lake. The samples collected on Pigeon Creek below Hogback Lake and from the Pigeon River as it entered the Fish and Wildlife Area had 53 and 102 *E. coli* per 100 mL respectively. Thirty-one sites (81.6%) did not meet the recreational use standard.

The sites were assessed as high, moderate, and slight impairment. Out of 38 sites there were 19 (50.0%) highly impaired sites, with the geometric means ranging from 1124 to 4479 *E. coli* per 100 mL. There were 6 (15.8%) sites of moderate impairment ranging from 610 to 995 *E. coli* per 100 mL. The 6 (15.8%) sites that were slightly impaired had mean levels from 131 to 525 *E. coli* per 100 mL.

Table 8 Summary of Water Quality Standard Findings for the North East Survey

North East Survey	Total	WQS	Meeting WQS	% Meeting WQS	Not Meeting WQS	% Not Meeting WQS
Sites	38	Geo-Mean less than 125	7	18.4 %	31	81.6 %
Water Samples	190	Sample less than 235	56	29.5%	134	70.5 %
Survey	Supports	Non-support	Non-support	Non-support		
Total Sites	Recreational Use	Highly Impaired	Moderately Impaired	Slightly Impaired		
38	7	19	6	6		

Figures 6, 7, 8, 9, 10, 11 and 12 illustrate the ranges of *E. coli* concentrations at each site.

Figure 6 *E. coli* Results in Selected Lakes of Northeast Indiana

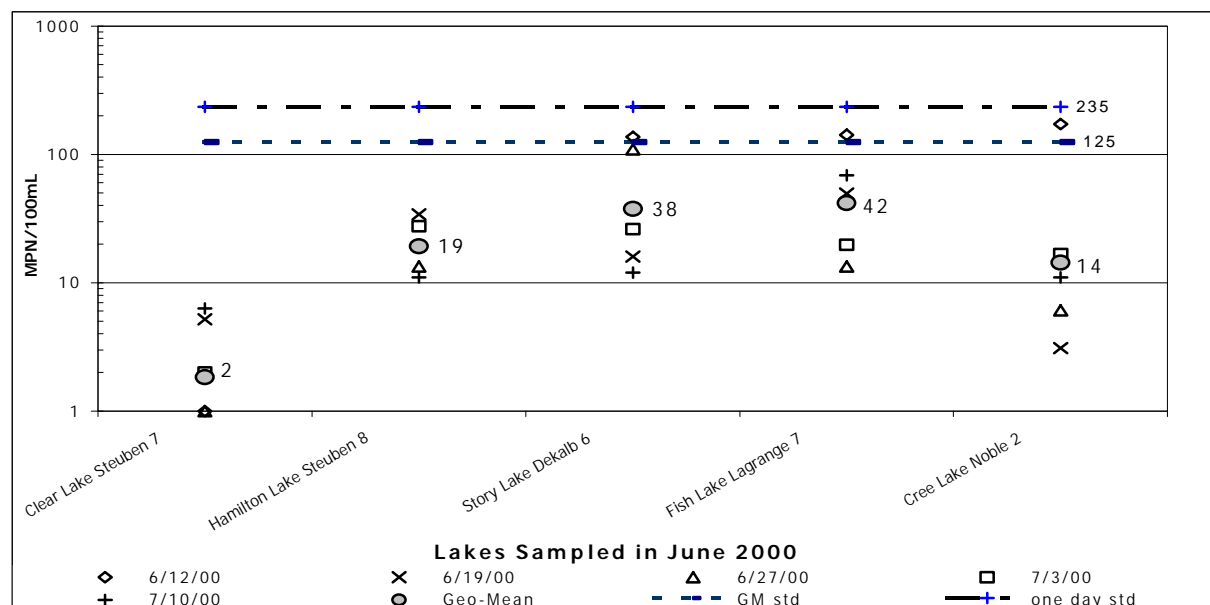


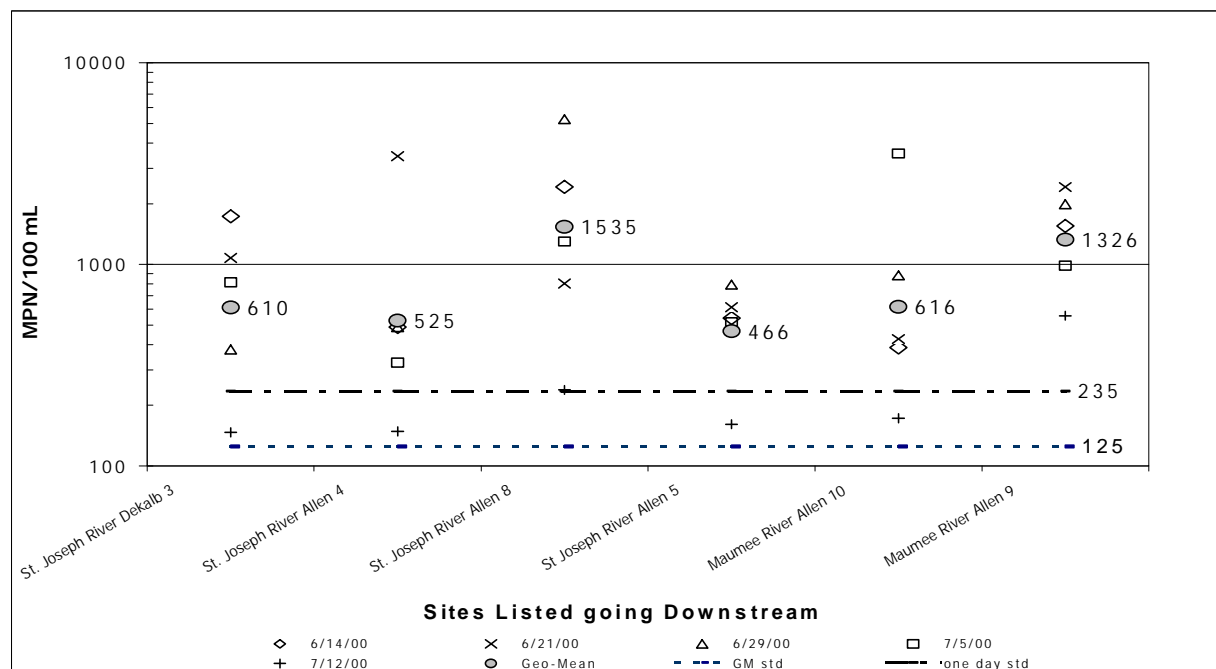
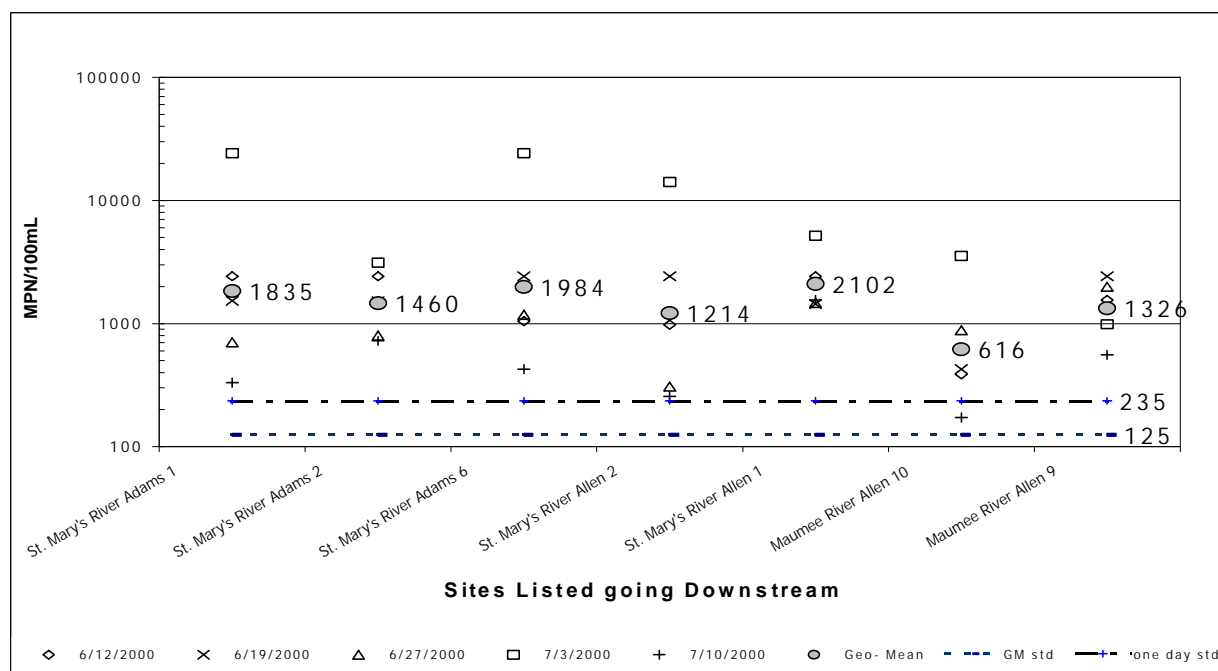
Figure 7 *E. coli* Results in St. Joseph River Watershed**Figure 8 *E. coli* Results in the St. Mary's River Watershed**

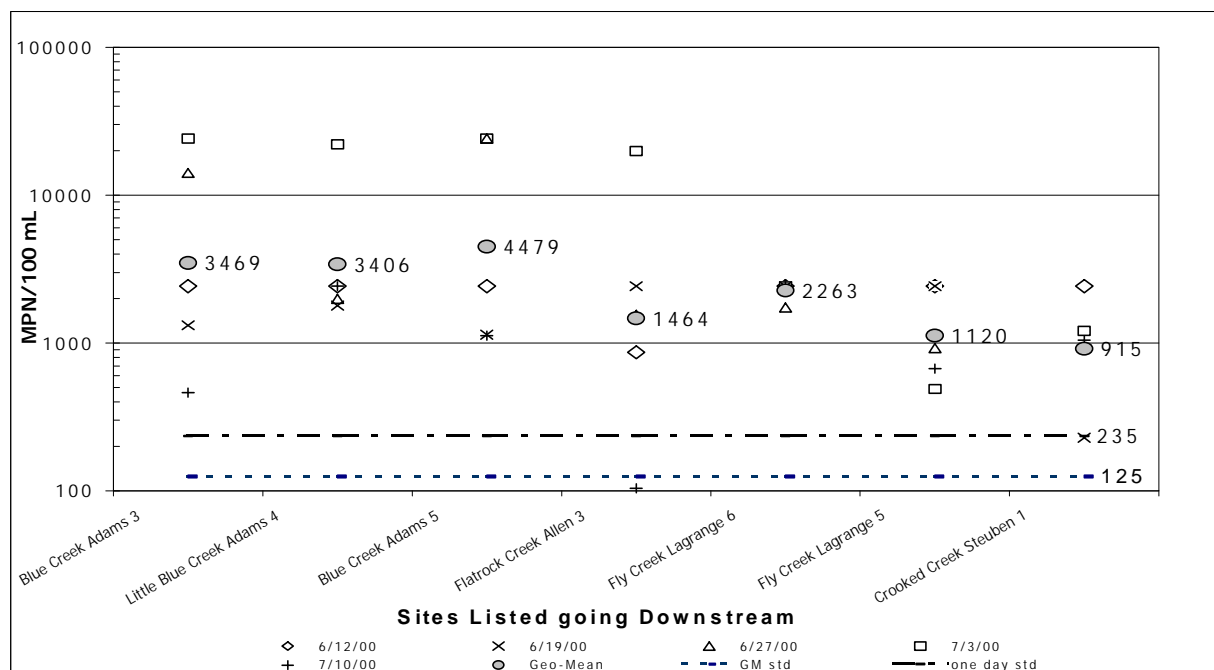
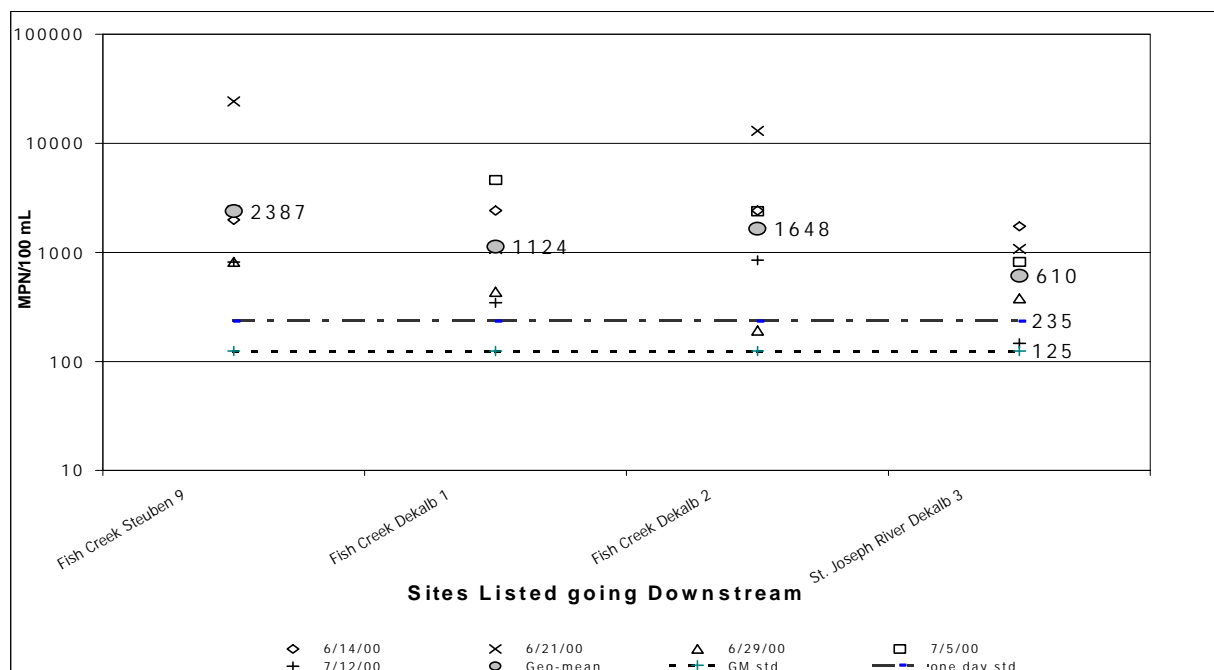
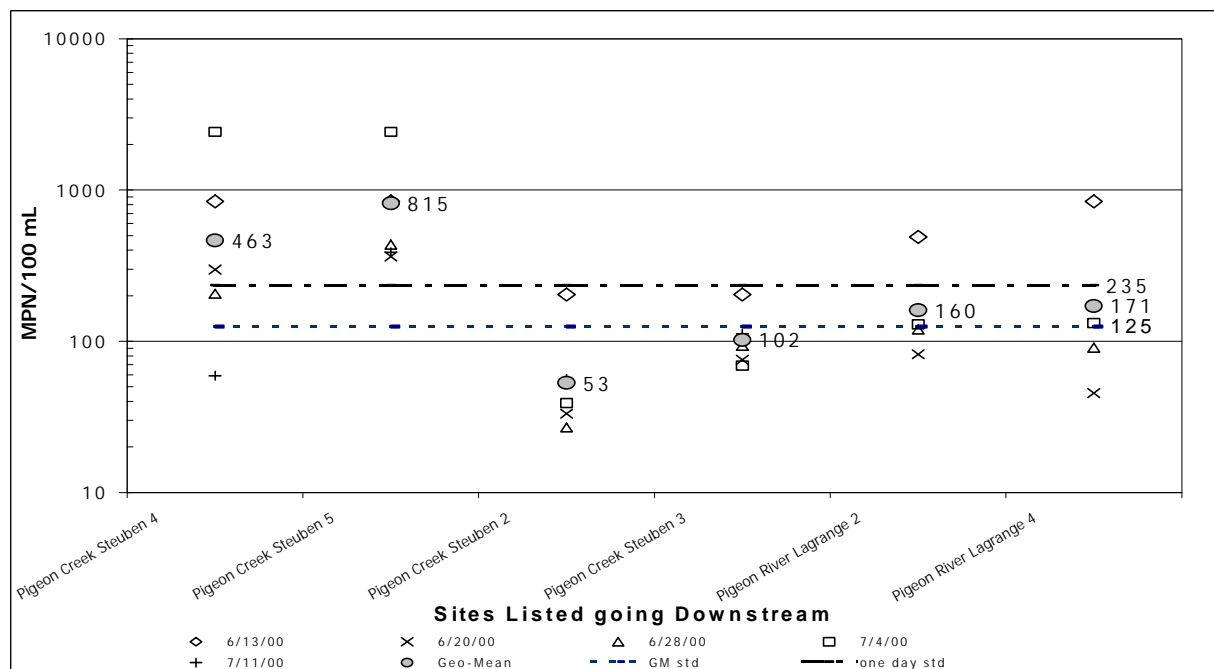
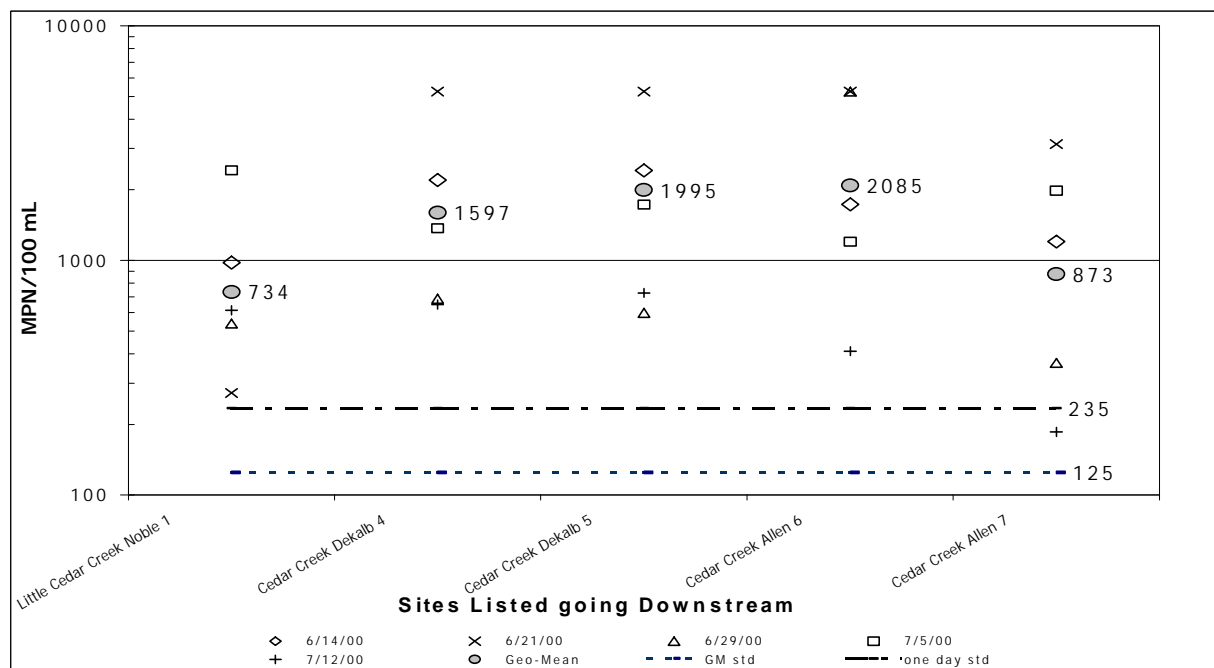
Figure 9 *E. coli* Results in Small Streams of Northeast Indiana**Figure 10 *E. coli* Results in Fish Creek**

Figure 11 *E. coli* Results in Pigeon River Watershed**Figure 12 *E. coli* Results in the Cedar Creek Watershed**

Results of the Lake Rim Survey

During the Lake Rim Survey conducted between July 24, 2000 and August 22, 2000, 31 (25.2%) water samples of 123 taken met the one day recreational standard of less than 235 *E. coli* per 100 mL. Of the 25 sites assessed only 3 (12.0%) sites met the five-sample geometric mean standard and were fully supporting of recreational activity. Table 9 summarizes the water quality conditions of the sites in the Lake Rim survey. The two lakes in the Lake Rim survey had geometric means of 16 *E. coli* per 100 mL at Long Lake and 28 *E. coli* per 100 mL at the outlet of Lake George, a Deep River site. The water samples collected on the Indiana Harbor Canal had a geometric mean of 51 *E. coli* per 100 mL. Twenty-two (88.0%) sites did not meet the recreational use standard.

The sites were assessed as high, moderate, and slight impairment. Out of 25 sites there were 3 (12%) highly impaired sites, with the geometric means ranging from 1014 to 3838 *E. coli* per 100 mL. There were 10 (40%) sites of moderate impairment ranging from 668 to 995 *E. coli* per 100 mL. The 9(36%) sites that were slightly impaired had mean levels from 149 to 549 *E. coli* per 100 mL.

Table 9 Summary of Water Quality Standard Findings for the Lake Rim Survey

Lake Rim Survey	Total	WQS	Meeting WQS	% Meeting WQS	Not Meeting WQS	% Not Meeting WQS
Sites	25	Geo-Mean less than 125	3	12 %	22	88 %
Water Samples	123	Sample less than 235	31	25.2 %	92	74.8 %
		Supports	Non-support	Non-support	Non-support	Non-support
Total Sites		Recreational Use	Highly Impaired	Moderately Impaired	Slightly Impaired	
25		3	3	10	9	

Figures 13, 14, 15 and 16 illustrate the ranges of *E. coli* concentrations at each site. The sites in the same watershed can also be compared to each other.

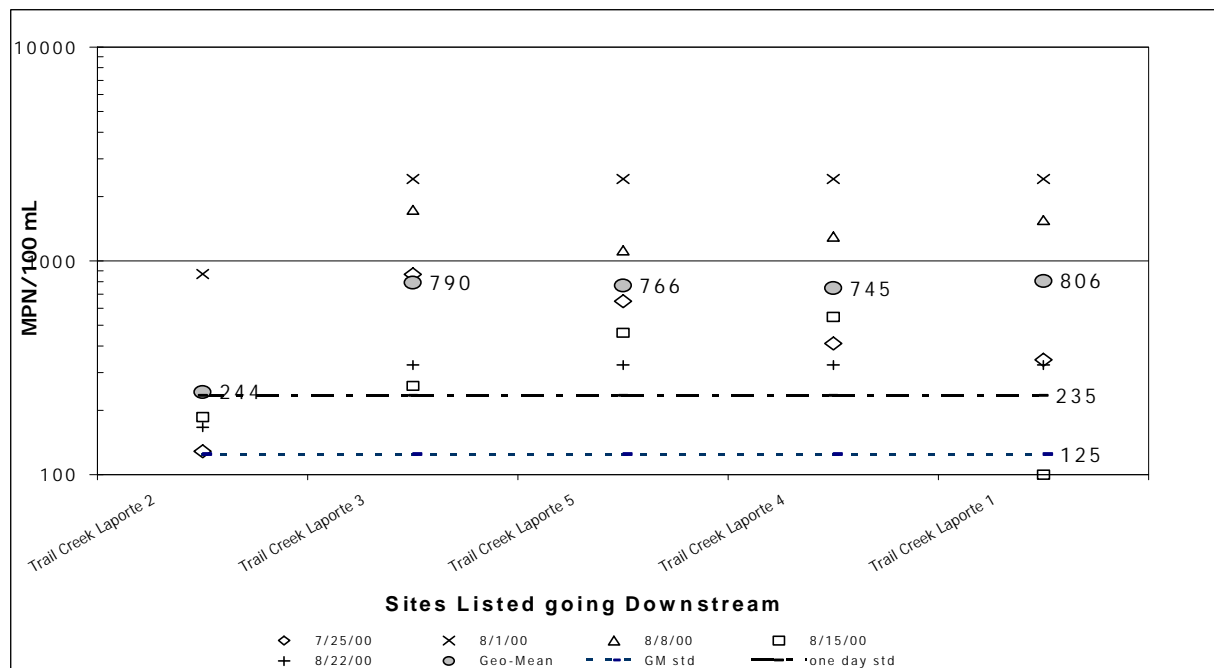
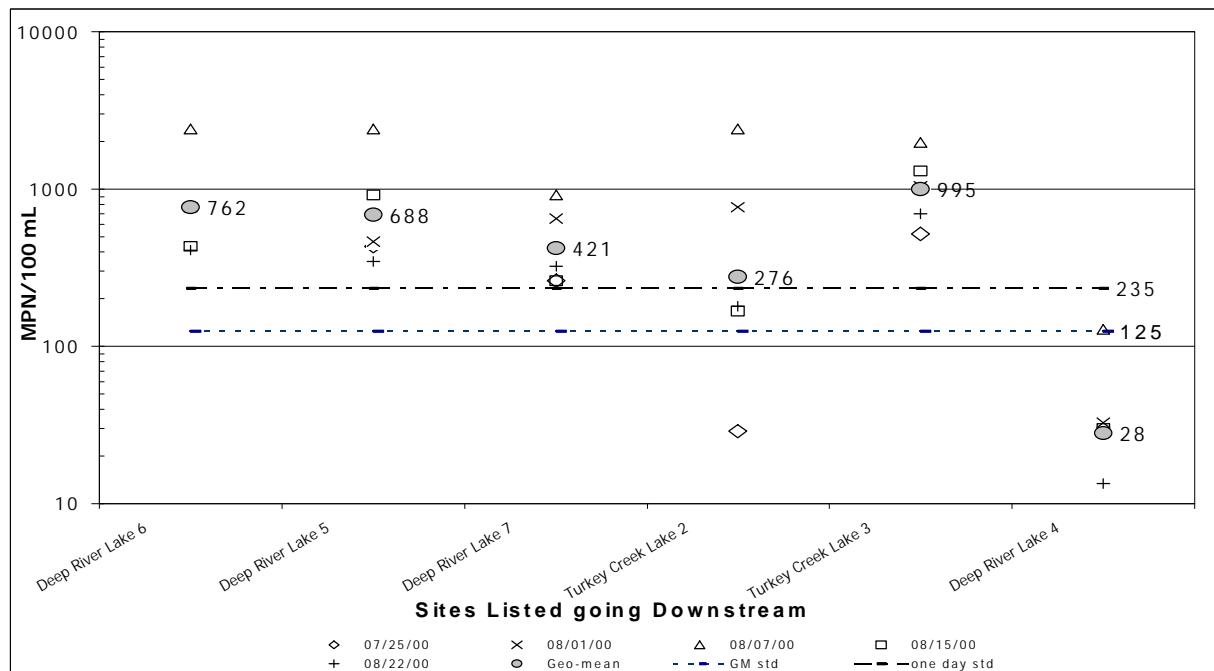
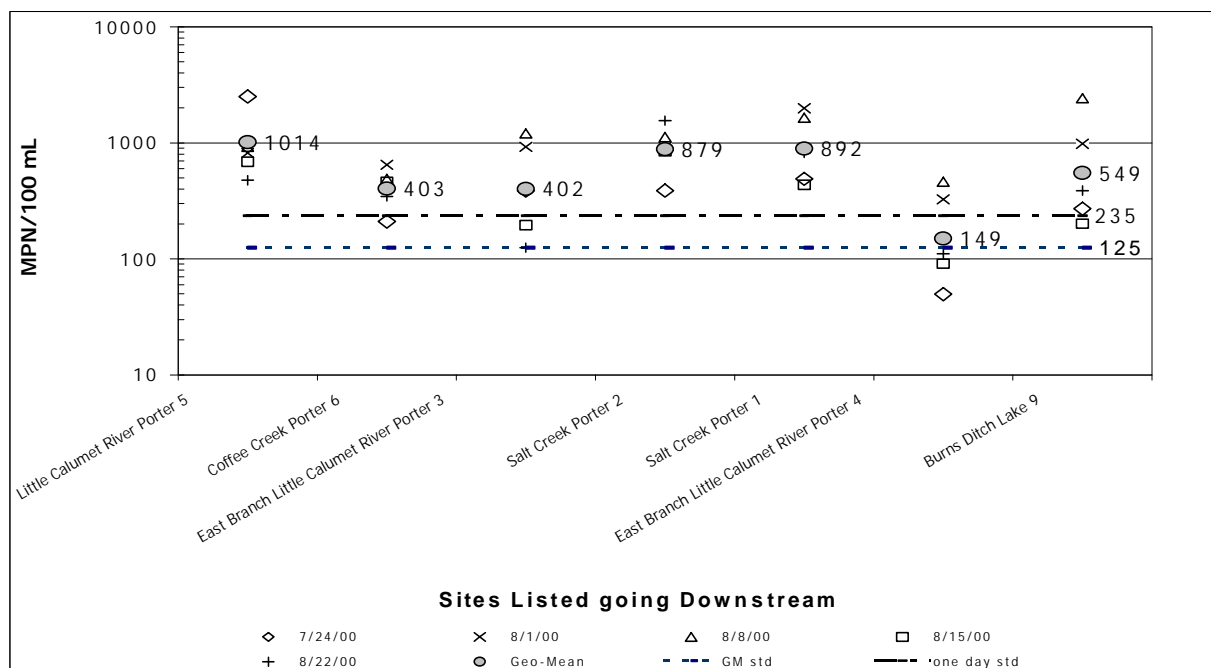
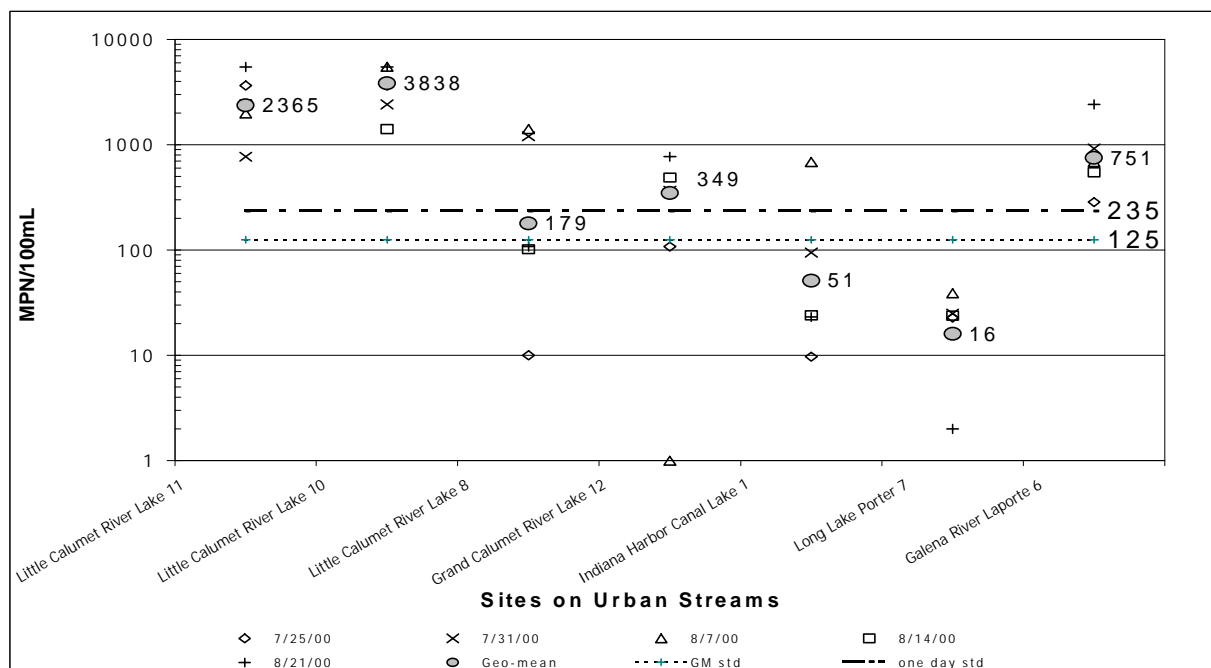
Figure 13 *E. coli* Results in Trail Creek**Figure 14 *E. coli* Results in the Deep River Watershed**

Figure 15 *E. coli* Results in the Salt Creek Watershed**Figure 16 *E. coli* Results in Small Steams of Northwest Indiana**

Results of the North Central Survey

During the North Central Survey, conducted between September 25, 2000 and October 26, 2000, 78 (54.5%) water samples of 143 taken met the one-day recreational standard of less than 235 *E. coli* per 100 mL. Of the 29 sites assessed 11 (37.9%) sites were fully supporting of recreational activity, meeting the five-sample geometric mean standard. Table 10 summarizes the water quality conditions of the sites in the North Central survey. The six lakes in the North Central Survey had geometric means of ranging from 3 *E. coli* per 100 mL at Shipshewana Lake to 17 *E. coli* per 100 mL at the outlet of Syracuse Lake, a Turkey Creek site. The samples collected at the 4 river sites and 1 creek site that met recreational use standards had geometric means ranging from 38 *E. coli* per 100 mL on the St. Joseph River downstream of Elkhart to 73 *E. coli* per 100 mL at Christiana Creek. Eighteen (62.1%) sites did not meet the recreational use standard.

The sites were assessed as high, moderate, and slight impairment. Out of 29 sites there were 4 (13.8%) highly impaired sites, with the geometric means ranging from 1112 to 1919 *E. coli* per 100 mL. There were 2 (6.9%) sites of moderate impairment with geometric means of 753 and 803 *E. coli* per 100 mL. The 12 (41.4%) sites that were slightly impaired had mean concentrations from 139 to 448 *E. coli* per 100 mL.

Table 10 Summary of Water Quality Standard Findings for the North Central Survey

North Central Survey	Total	WQS	Meeting WQS	% Meeting WQS	Not Meeting WQS	% Not Meeting WQS
Sites	29	Geo-Mean less than 125	11	37.9 %	18	62.1 %
Water Samples	145	Sample less than 235	80	55.2 %	65	44.8 %
Sites	Supports	Non-support	Non-support	Non-support		
Total Sites	Recreational Use	Highly Impaired	Moderately Impaired	Slightly Impaired		
29	11	4	2	12		

Figures 17, 18, 19, and 20 illustrate the ranges of *E. coli* concentrations at each site. The sites in the same watershed can also be compared to each other.

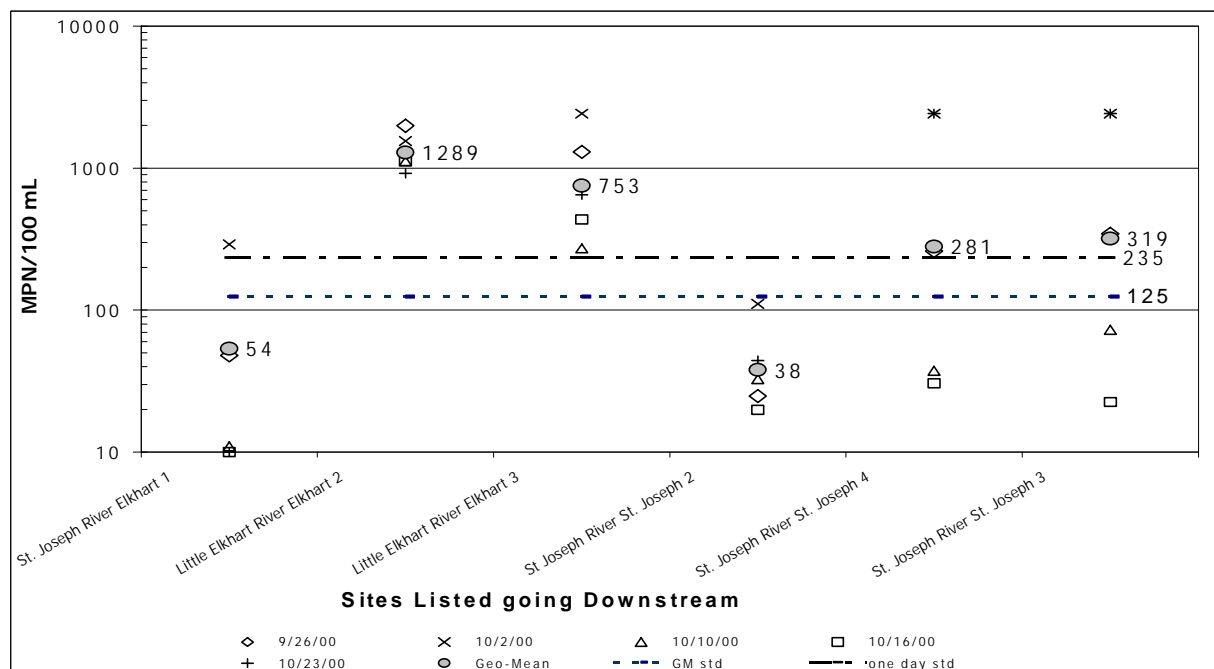
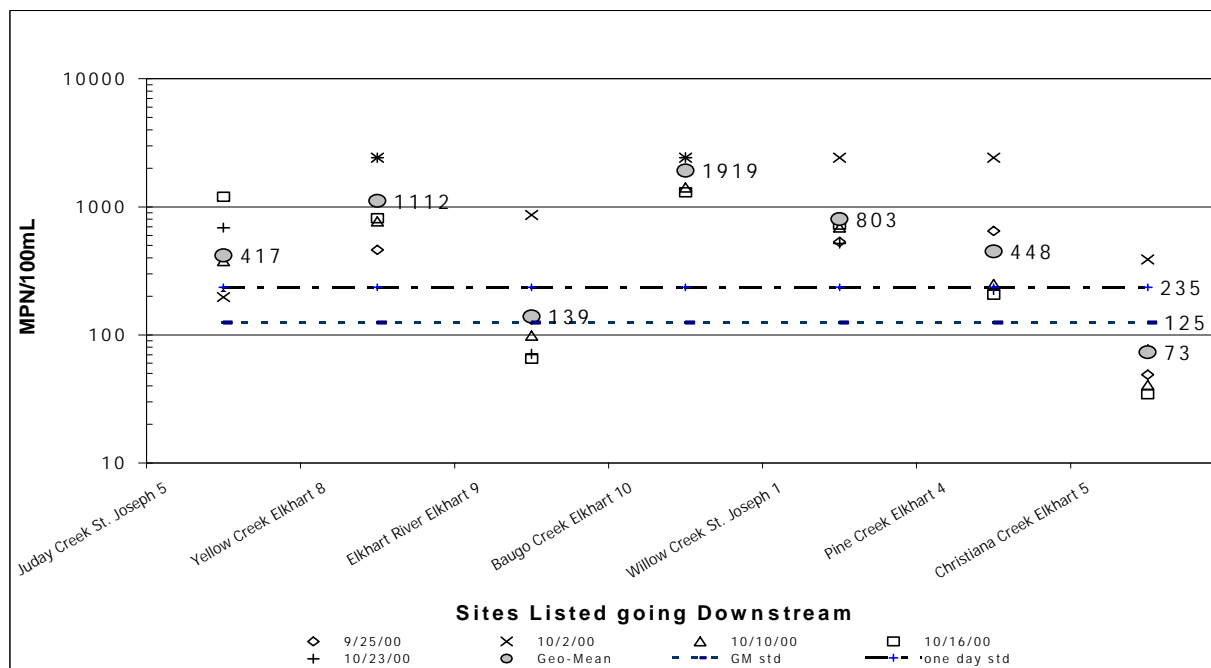
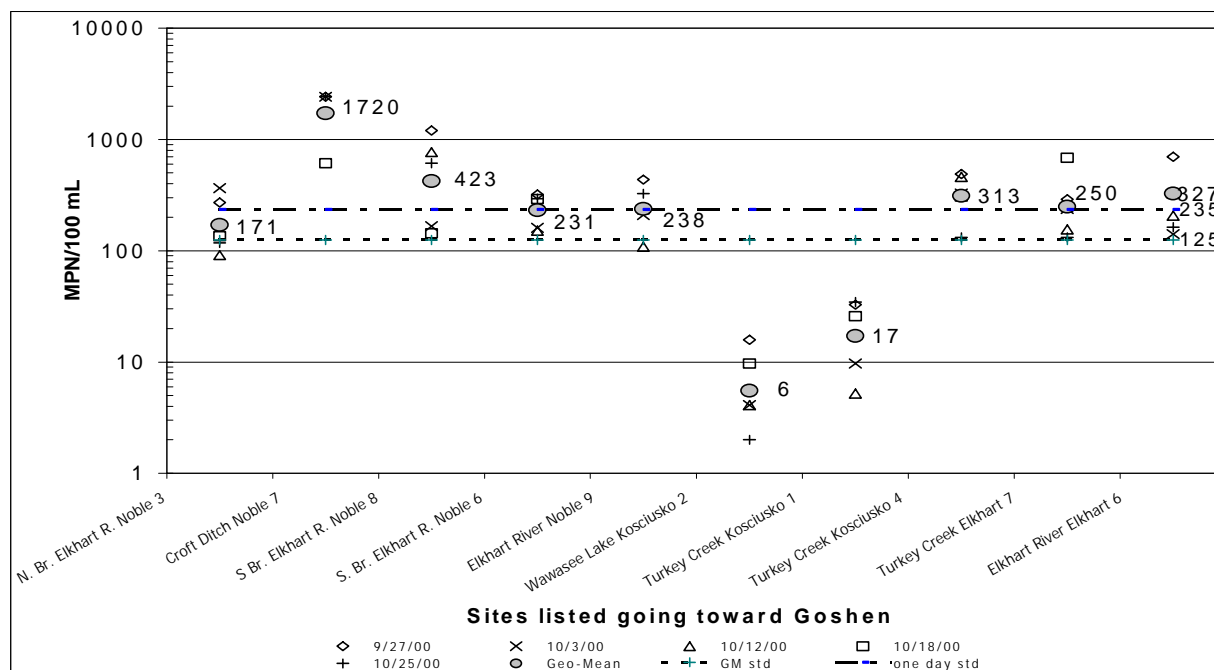
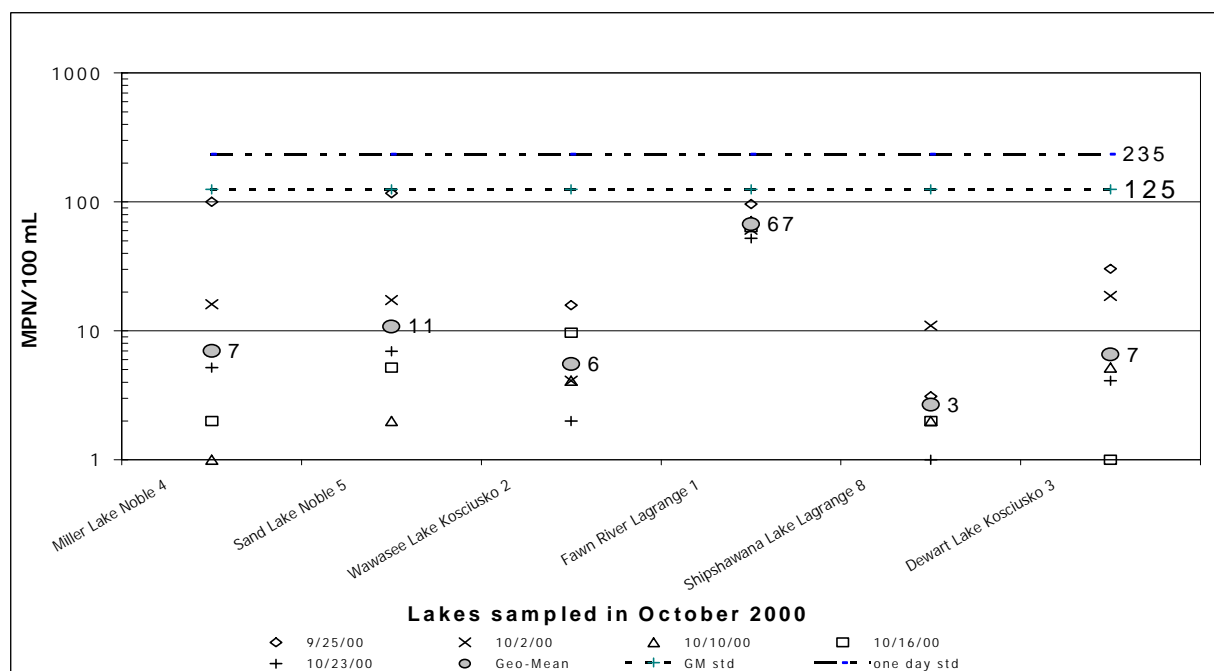
Figure 17 *E. coli* Results in the Little Elkhart and St. Joseph Rivers**Figure 18 *E. coli* Results in Tributaries of the St. Joseph River**

Figure 19 *E. coli* Results in the Upper Elkhart River**Figure 20 *E. coli* Results in North Central Indiana Lakes**

Predicting the Need for a 10 mL Dilution Volume

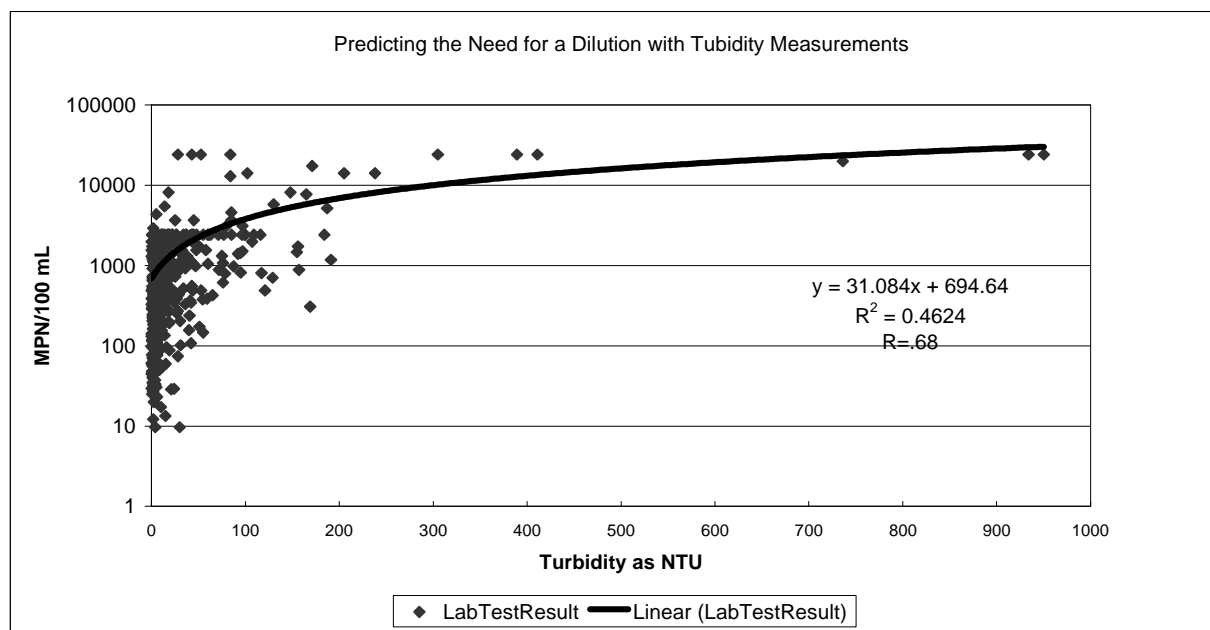
Staff associated with this project discovered that the use of best professional judgement was required to determine the need for a 10-mL dilution volume to obtain a useable result. Because this method uses a relatively large volume of sample, 100 mL, the results have a high degree of accuracy. At the same time, if the true value of the results are greater than 2400, the calculation of a geometric mean is skewed downward, and the magnitude of the problem is unknown. The sample collector needed a tool to standardize the decision making process to minimize the number of samples which had to be reported as greater than 2420 or Too Numerous To Count (TNTC). When using best professional judgement, previous results, recent rainfall and turbidity (clarity) were the factors considered when determining the need to test both a 100 mL sample volume and a 10 mL sample volume for *E. coli* measurement. Since previous results and rainfall in an area were often unknown to the sample collector, it was determined that staff should determine a level of turbidity that could guide decision making. Turbidity was chosen because it is measured at every sampling event as part of the field data.

Data from the three water sampling surveys were analyzed to determine if there was a correlation between turbidity and *E. coli* results (See Figure 20). The best-fit regression line in the graph was constructed for dilution prediction purposes. The following equation is the equation of the best fit regression line ($R = 0.6800$) generated when *E. coli* concentrations were plotted versus turbidity results while using the Least Squares method.

$$y = 31.084x + 694.64 \quad R^2 = 0.4624 \quad R = .68$$

These statistical factors can be interpreted by assigning 46% of the reason that the *E. coli* results can be predicted as high enough to require a dilution is due to turbidity, while 54% of the reason can be attributed to other factors, such as direct pollution or run off. The predictor will work only 68% of the time.

Figure 21 Estimating *E. coli* Concentrations using Turbidity



By substituting 2420 MPN/100mL (the maximum *E. coli* concentration that can be determined by the Colilert method without dilution) for Y in the equation above, a turbidity of 54.8 NTU, or simply 55 NTU, indicates the threshold for dilution. It is proposed that this dilution prediction method should result in considerably fewer results of TNTC test results, especially during the first week of sampling when no historical *E. coli* data for the sites are available. In order to provide a margin of safety, which would help account for the other factors involved, multiply the 55 NTU by 0.75 for a conservative dilution threshold. In this case, a water sample over 40 NTU should be diluted in a 1:10 ratio during *E. coli* analyses. To test the theory, the data from this study were examined categorically.

Samples reported as greater than 2419.2, or TNTC (See Table X Appendix B). In the 456 stream samples examined, best professional judgement failed to predict the need for a dilution in 43 (10.6%) samples resulting in data reported as >2419.2. Of those 43 TNTC samples, 16 had turbidity above 40 NTU. If this rule had been applied, those 16 would have been diluted, reducing the TNTC results by 37.2%. Also, 18 of those 43 water samples were taken in the first week of the surveys. If this rule had been applied, 11 (61.1%) of those 18 samples would have been diluted, establishing the severity of the pollution early in the survey. By using a turbidity threshold, the number of samples analyzed incompletely would have been reduced significantly.

Diluted Samples (See Table Y Appendix B). Best professional judgement and previous test results determined that of the 456 water samples 99 (21.7%) needed to have 10 mL sample volumes tested. Of the 61 samples that used the 10 mL sample volume to determine the *E. coli* concentration, 43 (70.5%) had turbidity above 40 NTU. The other 38 water samples used the 100 mL sample volume for results, but only 5 (12.5%) had turbidity greater than 40.

High Turbidity Samples (See Table Z Appendix B). Out of 456 water samples, 82 (18%) water samples had turbidity higher than 40 NTU. Of those 82, 23 (28%) samples had *E. coli* results of less than 2419.2. Of the 59 other samples, 16 test results were TNTC without the dilution and the other 43 were diluted. Five of the diluted samples were still TNTC at > 24,200 MPN per 100 mL. Best professional judgement made 16 (19.5%) mistakes. If high turbidity had been the first criteria for testing a 10 mL sample volume, 23 (28.4%) mistakes on the side of caution would have been made.

Low Turbidity Samples (See Table Z Appendix B). 373 water samples had turbidity below 40 NTU. 44 (11.8%) of those needed to be diluted to obtain an accurate result. Weather condition and past experience at the sites provided enough information to accurately predict the need for a 10 mL dilution volume in 18 (4.8%) of the samples. Out of 373 samples, 33 (8.8%) of the samples were diluted unnecessarily and 27 (7.2%) samples failed to be diluted when it was needed. Best professional judgement made 60 (16.1%) mistakes. If turbidity had been the sole criteria, 50 (13.4%) mistakes would have been made. This rate could be reduced further if previous test results and weather conditions at a site was a factor in the decision making process.

In conclusion, staff should use a turbidity criteria of 40 NTU as an indicator of the need to dilute a Colilert® sample in a 1:10 ratio to reduce the number of results beyond the limit of quantification for 100 mL sample volumes. Previous sample results and weather conditions still need to be considered when turbidity is low. With experience, the sample collector should be able to make the determination whether to collect enough sample to test a 10 mL sample volume. Materials used as a result of errors on the side of caution can be reduced by running only the 10 mL sample volume when turbidity is greater than 55 NTU.

CONCLUSIONS

Recreational Use Attainment

Concentrations of *E. coli* at all 92 sites ranged from less than 1 to over 24,000 per 100 mL, expressed as the MPN of *E. coli*. This is the possible range of the test method using volumes of 100 or 10 mL per sample. Samples meeting the one-day recreational standard numbered 165 (36.2%) out of 456. Samples testing higher than 235 MPN/100 mL numbered 291 (63.8%).

The calculated five-sample geometric mean met the water quality standard at 21 (22.8%) of the 92 sites. The geometric means of the 71 (77.2%) sites that did not support recreational use ranged from 131 to 4479. Twenty-six sites (28.3%) were highly impaired, 18 (19.6%) were moderately impaired, and 27 (29.3%) were slightly impaired for recreational use.

These findings are similar in proportion to the findings of the USGS surveys of the Upper Wabash watershed in 1998 (Silcox et al 2000), the Lower Wabash River and the Kankakee River watersheds in 1999 (Silcox et al 2001), and the Ohio River watershed in 2000 (Silcox et al 2002). In 1998, 63% of the water samples tested were above 235 cfu/100 mL and 43 (93.5%) of 46 sites did not meet the water quality standard for the five sample geometric mean. In 1999, 43% of the water samples tested were above 235 cfu/100 mL and 38 (65.5%) of 58 sites did not meet the water quality standard for the five sample geometric mean. In 2000, 36% of the water samples tested were above 235 cfu/100 mL and 24 (60%) of 40 sites did not meet the water quality standard for the five sample geometric mean.

Since all the waters of the State have been designated for full body contact recreational use, these findings presents a huge challenge to the State of Indiana to attain the goal of all waters to support their designated uses of swimmable and fishable.

Table 11 Summary of Water Quality Standard Findings of *E. coli* Surveys June–October 2000

All Surveys	Total	WQS	Meets WQS	% Meeting WQS	Do Not Meet WQS	% Not Meeting WQS
Sites	92	Geo-Mean less than 125	21	22.8 %	71	77.2 %
Samples	456	Sample less than 235	165	36.2 %	291	63.8 %
All Routes		Supports	Non-support		Non-support	Non-support
Total Sites	Recreational Use		Highly Impaired	Moderately Impaired	Slightly Impaired	
92	21		26	18	27	

Use of the Mobile Laboratory for *E. coli* Testing

The use of the mobile laboratory greatly improved the ability to assess waters of the State for recreational use. When *E. coli* concentrations were very high despite dry weather conditions or high degrees of clarity, further work was done to identify the source of serious pollution problems. The cost and manpower saved using these methods rather than contracting with the USGS in a co-operative program, as was done from 1998 to 2000, was considerable. The number of sites surveyed was doubled. The ability of testing samples that were collected by other Survey crews for Source Identification investigations was tested successfully. The equipment operated effectively.

At the end of the survey, the only change in the original plan was to replace the small gravity convection incubators with one large incubator that could cool as well as heat. The original incubators were difficult to control when temperatures in the van changed. The small incubators will continue to be used in the Surveys Section work area and in hotel rooms when necessary.

A final report on the Statewide *E. coli* Project Grant is being completed at this time, reporting on the budget and utilization of the Mobile Laboratory. A second year of surveying was completed to study the West Fork of the White River and the Patoka River Watersheds. The methods and materials developed during this initial survey have been adopted by the TMDL work group. The work group will obtain a similar mobile laboratory to maximize the sampling of impaired waterbodies for the purpose of modeling for the reduction of *E. coli* to correct the impairments.

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APPENDIX A

Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Adams 1	LES040-0007	St. Mary's River	SR 101 bridge North of Pleasant Mills	6/12/00	4:15 PM	AA002171	2419.2	Brown	109	22.4	7.63	684	7.15	85.6	Cloudy	76-85	East	Mod./Light	Run
				6/19/00	5:40 PM	AA00332	1527	Brown	92	19.66	7.43	639	7.79	87.4	Clear	76-85	South	Calm	Run
				6/27/00	2:52 PM	AA00480	703	Brown	129	22.08	7.42	419	6.34	75.4	Ptly Cloudy	76-85	West	Mod./Light	Run
				7/3/00	2:20 PM	AA00561	24192	Brown	950	21.87	7.64	478	6.95	81.7	Ptly Cloudy	76-85	West	Light	Run
				7/10/00	3:20 PM	AA00654	331	Green	36	23.17	7.81	789	8.13	98.5	Cloudy	76-85	South	Light	Run
				Geometric Mean			1835												
Adams 2	LES040-0008	St. Mary's River	Keokiong Park, Decatur, off Salem Rd.	6/12/00	4:50 PM	AA00216	2419.2	Brown	96.2	22.81	7.76	739	7.24		Rain	76-85	North	Calm	Run
				6/19/00	6:00 PM	AA00287	1515	Brown	97	19.55	7.39	639	7.61	85.5	Clear	76-85	South	Mod./Light	Run
				6/27/00	3:10 PM	AA00447	800.5	Brown	157	22.04	7.44	433	6.37	75.3	Ptly Cloudy	76-85	West	Light	Run
				7/3/00	2:45 PM	AA00559	3130	Brown	97	22.91	7.84	727	7.51	90.3	Ptly Cloudy	76-85	West	Mod./Light	Run
				7/10/00	3:50 PM	AA00669	723	Brown	25	23.62	7.88	785	8.35		Cloudy	76-85	South	Light	Run
				Geometric Mean			1460												
Adams 3	LES040-0009	Blue Creek	SR 124, East of CR 500 E.	6/12/00	4:05 PM	AA00215	2419.2	Brown	77	21.9	7.43	569	6.56	77	Cloudy	76-85	East	Mod./Light	Riffle
				6/19/00	5:25 PM	AA00286	1317	Brown	75	20.25	7.33	727	8.06	92.1	Clear	76-85	South	Calm	Run
				6/27/00	2:40 PM	AA00444	14136	Brown	102	21.35	7.5	645	6.9	80.6	Ptly Cloudy	76-85	West	Mod./Light	Run
				7/3/00	2:10 PM	AA00558	24191.1	Brown	934	21.34	7.53	264	6.87	79.9	Ptly Cloudy	76-85	West	Light	Run
				7/10/00	3:05 PM	AA00712	461.1	Brown	25	23.62	7.91	1009	7.88	96.3	Cloudy	76-85	South	Light	Run
				Geometric Mean			3469												

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County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Adams 4	LES040-0010	Little Blue Creek	CR 400 S. bridge, West of CR 500 E	6/12/00	3:17 PM	AA00211	2419.17	Murky	19.4	23.9	7.66	745	9.57	117	Cloudy	76-85	North	Mod./Light	Run
				6/19/00	4:58 PM	AA00285	1789	Brown	27	21.7	7.59	700	9.03	105	Clear	76-85	South	Light	Run
				6/27/00	2:15 PM	AA00442	1986.28	Murky	24	22.56	7.82	719	9.53	114.3	Ptly Cloudy	76-85	West	Mod./Light	Run
				7/3/00	1:45 PM	AA00555	22027.05	Brown	389	20.83	7.17	277	6.5	75.1	Ptly Cloudy	76-85	West	Light	Run
				7/10/00	2:45 PM	AA00645	2419.2	Clear	10	24.27	8.09	7.93	11.49	142.1	Cloudy	76-85	South	Calm	Run
				Geometric Mean						3406									
Adams 5	LES040-0011	Blue Creek	Salem Rd, South of CR 300 S.	6/12/00	3:42 PM	AA00213	2419.2	Brown	55	22.2	7.33	800	6.78	85.4	Cloudy	76-85	East	Light	Riffle
				6/19/00	5:07 PM	AA00335	1137	Brown	42	20.84	7.06	805	7.43	85.8	Clear	76-85	South	Light	Run
				6/27/00	2:25 PM	AA00443	24192	Brown	52.7	22.12	7.27	800	6.39	75.7	Ptly Cloudy	76-85	West	Mod./Light	Run
				7/3/00	1:55 PM	AA00557	24192	Murky	411	21.82	7.23	247	6.32	74.2	Ptly Cloudy	76-85	West	Calm	Run
				7/10/00	2:45 PM	AA00653	1119.85	Clear		23.42	7.62	1050	8.1		Cloudy	76-85	South	Light	Riffle
				Geometric Mean						4479									
Adams 6	LES050-0004	St. Mary's River	CR 900 N bridge, East of Winchester Rd.	6/12/00	5:07 PM	AA00218	1046.24	Brown	60.2	22.9	7.79	829	7.36	88.2	Cloudy	76-85	North	Calm	Run
				6/19/00	6:20 PM	AA00288	2419.2	Brown	99	19.2	7.4	6.2	7.79	86.4	Clear	76-85	South	Calm	Run
				6/27/00	3:15 PM	AA00449	1178	Brown	191	21.95	7.42	448	6.68	78.8	Ptly Cloudy	76-85	West	Light	Run
				7/3/00	3:05 PM	AA00560	24192	Brown	305	21.82	7.53	407	6.7	78.9	Ptly Cloudy	76-85	West	Light	Run
				7/10/00	4:05 PM	AA00659	426	Brown	28	23.6	7.84	844	8.28	101	Cloudy	> 86	South	Light	Run
				Geometric Mean						1984									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Allen 1	LES060-0004	St Mary's River	Pedestrian bridge, Festival Park, Fort Wayne	6/13/00	9:10 AM	AA00230	2419.2	Brown	85.2	22.6	7.57	709	6.41	76.7	Ptly Cloudy	61-75	West	Mod./Light	Run
				6/20/00	8:40 AM	AA00295	1439	Brown	94.6	19.07	7.46	598	8.03	88.2	Scattered	76-85	South	Mod./Light	Run
				6/28/00	8:25 AM	AA00456	1467	Brown	155	20.12	7.51	497	6.78	77.1	Ptly Cloudy	61-75	North	Calm	Run
				7/4/00	8:20 AM	AA00566	5172	Brown	187	21.54	7.35	425	6.03	70.5	Cloudy	61-75	South	Light	Run
				7/11/00	8:40 AM	AA00666	1553.07	Green	32.5	22.46	7.72	707	7.72	91.9	Ptly Cloudy	61-75	South	Light	Run
				Geometric Mean						2102									
Allen 2	LES060-0005	St Mary's River	Ferguson Rd bridge, West of Winchester	6/12/00	5:35 PM	AA00219	980.4	Brown	87.5	22.64	7.84	765	7.64	91	Cloudy	76-85	North	Calm	Run
				6/19/00	6:45 PM	AA00289	2419.2	Brown	184	19.44	7.37	591	7.5	84.5	Clear	76-85	South	Calm	Run
				6/27/00	3:55 PM	AA00451	307.6	Brown	169	21.66	7.51	529	6.9	81.3	Ptly Cloudy	76-85	West	Light	Run
				7/3/00	3:30 PM	AA00562	14136	Brown	238	22.16	7.57	512	6.87	81.4	Ptly Cloudy	76-85	West	Light	Run
				7/10/00	4:30 PM	AA00660	256	Brown	27	23.2	7.85	723	8.3	100.7	Cloudy	> 86	South	Calm	Run
				Geometric Mean						1214									
Allen 3	LEA120-0005	Flatrock Creek	Old US 30 bridge, East of SR 101	6/12/00	6:10 PM	AA00220	866.4	Green	13.6	22.18	7.76	766	7.47	88.3	Cloudy	61-75	East	Light	Riffle
				6/19/00	7:40 PM	AA00291	2419.2	Murky	44.8	19.79	7.31	570	7.95	88.6	Clear	76-85	South	Calm	Run
				6/27/00	4:25 PM	AA00452	1553.07	Brown	47.8	20.25	7.58	606	7.76	88.7	Cloudy	76-85	West	Light	Run
				7/3/00	4:05 PM	AA00563	19863	Brown	736	22.12	7.44	464	6.83	81	Ptly Cloudy	76-85	West	Light	Run
				7/10/00	5:05 PM	AA00662	103.9	Green	6.1	22.8	7.76	772	7.37	88.7	Cloudy	76-85	South	Light	Run
				Geometric Mean						1464									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Allen 4	LEJ070-0006	St. Joseph River	Grabill Rd. bridge	6/14/00	2:25 PM	AA00222	488.4	Brown	121	22.14	7.59	389	6.3	74.3	Cloudy	61-75	West	Mod./Strong	Run
				6/21/00	11:55 AM	AA00329	3448	Brown	95	20.83	7.39	430	6.78	77.5	Ptly Cloudy	76-85	West	Mod./Strong	Run
				6/29/00	11:55 AM	AA00519	488.4	Green	52.9	21.14	7.56	371	6.43	74.6	Ptly Cloudy	76-85	West	Moderate	Run
				7/5/00	11:50 AM	AA00607	325.5	Brown	37	23.1	7.66	486	6.29	75.5	Scattered	76-85	South	Light	Run
				7/12/00	12:45 PM	AA00704	148.5	Brown	40	22.77	7.78	572	7.02	84.3	Scattered	76-85	East	Light	Run
				Geometric Mean			525												
Allen 5	LEJ100-0003	St. Joseph River	Tennessee St. bridge, Fort Wayne	6/13/00	9:42 AM	AA00228	541.6	Brown	29	22.66	7.87	566	8.34	99.8	Cloudy	76-85	South	Light	Run
				6/20/00	9:10 AM	AA00299	613	Brown	76	20.97	7.6	443	8.13	93.8	Scattered	76-85	South	Mod./Light	Run
				6/28/00	8:55 AM	AA00464	794	Brown	78.2	20.5	7.5	370	7.73	88.5	Ptly Cloudy	61-75	North	Calm	Run
				7/4/00	8:50 AM	AA00571	517.2	Murky	34	22.67	7.78	473	7.81	92.8	Cloudy	61-75	South	Light	Run
				7/11/00	9:10 AM	AA00670	161	Brown	28	22.57	7.86	543	8.16	97.7	Ptly Cloudy	76-85	South	Light	Run
				Geometric Mean			466												
Allen 6	LEJ090-0008	Cedar Creek	SR 427, 3 Miles North of SR 1, Northwest of Cedarville	6/14/00	2:05 PM	AA00225	1732.87	Brown	50.8	21.33	7.82	705	7.94	92.4	Rain	61-75	North	Light	Run
				6/21/00	11:40 AM	AA00328	6330.5	Brown	130	19.9	7.17	567	7.87	88.6	Ptly Cloudy	76-85	West	Mod./Light	Run
				6/29/00	11:35 AM	AA00517	7270	Brown	24	19.39	7.68	616	7.95	89.4	Scattered	76-85	West	Mod./Light	Run
				7/5/00	11:30 AM	AA00606	1203.31	Brown	17	22.23	7.81	661	7.55	89.4	Scattered	76-85	South	Light	Run
				7/12/00	12:30 PM	AA00702	410.6	Green	11	20.86	7.94	784	8.51	98.2	Scattered	76-85	East	Light	Run
				Geometric Mean			2085												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Allen 7	LEJ090-0011	Cedar Creek	SR 1, South of Cedarville	6/14/00	2:35 PM	AA00212	1203.31	Brown	34.2	21.71	7.89	690	8.1	94.8	Cloudy	61-75	West	Mod./Light	Run
				6/21/00	12:10 PM	AA00330	3130	Brown	80	20.22	7.7	631	7.95	90.2	Ptly Cloudy	76-85	West	Moderate	Riffle
				6/29/00	12:05 PM	AA00520	365.4	Brown	41.2	19.93	7.72	613	8	90.9	Ptly Cloudy	76-85	West	Moderate	Riffle
				7/5/00	12:05 PM	AA00608	1986.28	Brown	22	22.51	7.85	658	7.65	91.2	Scattered	76-85	South	Light	Run
				7/12/00	1:00 PM	AA00706	186	Brown	8	21.37	8.03	782	8.87	103.6	Scattered	76-85	East	Light	Run
				Geometric Mean			873												
Allen 8	LEJ100-0004	St. Joseph River	Canoe Launch across from IUPUFW	6/13/00	8:30 AM	AA00226	2419.2	Brown	63	23.43	7.53	471	5.91	71	Ptly Cloudy	61-75	West	Light	Run
				6/20/00	8:11 AM	AA00294	805	Brown	117	20.7	7.49	483	7.07	81	Scattered	61-75	South	Mod./Light	Run
				6/28/00	8:00 AM	AA00454	14136	Brown	205	17.94	7.39	446	5.78	62.9	Ptly Cloudy	61-75	West	Light	Run
				7/4/00	7:50 AM	AA00565	1299.65	Murky	38	22.73	7.7	481	6.96	82.9	Cloudy	61-75	South	Light	Run
				7/11/00	8:10 AM	AA00665	238.2	Brown	40.4	22.18	7.76	544	7.19	85.5	Cloudy	61-75	North	Light	Run
				Geometric Mean			1535												
Allen 9	LEM010-0013	Maumee River	SR 101 bridge, 3 Miles North of Woodburn	6/12/00	6:35 PM	AA00221	1553.07	Brown	58	22.94	7.88	613	7.86	94	Cloudy	76-85	West	Calm	Run
				6/19/00	7:40 PM	AA00293	2419.2	Brown	116	20.64	7.48	444	7.67	87.4	Cloudy	61-75	South	Calm	Run
				6/27/00	4:45 PM	AA00453	1989	Brown	107	22.1	7.48	400	7.05	83.4	Scattered	76-85	West	Light	Run
				7/3/00	4:30 PM	AA00564	987	Brown	47	23.06	7.77	478	7.57	91.3	Ptly Cloudy	76-85	West	Light	Run
				7/10/00	5:35 PM	AA00664	556	Brown	43	23.85	7.81	569	7.59	93.1	Cloudy	76-85	South	Light	Run
				Geometric Mean			1326												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Allen 10	LEM010-0015	Maumee River	Lake Ave. bridge, D/S of Filtration Plant	6/13/00	9:30 AM	AA00227	387.3	Brown	59	22.76	7.91	558	8.48	101.2	Cloudy	76-85	South	Light	Eddy
				6/20/00	8:55 AM	AA00296	426	Brown	65	20.91	7.59	448	8.4	95.3	Scattered	76-85	South	Mod./Light	Eddy
				6/28/00	8:45 AM	AA00461	882	Brown	71.7	20.47	7.53	363	7.68	87.6	Ptly Cloudy	61-75	North	Light	Eddy
				7/4/00	8:35 AM	AA00569	3551	Brown	85	22.16	7.6	446	7.09	83.9	Cloudy	61-75	South	Light	Eddy
				7/11/00	8:55 AM	AA00667	172.3	Brown	51	22.43	7.83	543	8.11	96.5	Ptly Cloudy	76-85	South	Light	Eddy
				Geometric Mean			616												
Dekalb 1	LEJ050-0007	Fish Creek	79th Road bridge, South of Artic	6/14/00	10:35 AM	AA00254	2419.17	Brown	43	20.9	7.67	466	7.24	83.8	Scattered	76-85	North	Mod./Light	Run
				6/21/00	10:15 AM	AA00322	1071	Brown	43.2	19.73	7.62	536	7.53	84.5	Ptly Cloudy	61-75	West	Moderate	Run
				6/29/00	10:10 AM	AA00511	435.2	Brown	24	19.34	7.7	534	7.62	86	Scattered	76-85	West	Mod./Light	Run
				7/5/00	10:00 AM	AA00600	4611	Brown	85	21.66	7.76	472	7.25	85.1	Clear	76-85	East	Light	Run
				7/12/00	9:55 AM	AA00698	344.8	Brown	24	19.27	7.93	655	8.09	90.6	Cloudy	61-75	East	Light	Run
				Geometric Mean			1124												
Dekalb 2	LEJ050-0008	Fish Creek	4th Rd. bridge East of SR 1	6/14/00	10:15 AM	AA00253	2419.2	Brown	36.6	20.66	7.68	511	7.6	87.6	Scattered	76-85	West	Mod./Light	Run
				6/21/00	9:55 AM	AA00321	12996	Brown	84	19.32	7.68	577	7.9	87.9	Cloudy	76-85	West	Moderate	Run
				6/29/00	9:45 AM	AA00508	191.8	Green	19	19.6	7.71	524	7.51	84.6	Scattered	76-85	West	Light	Run
				7/5/00	9:40 AM	AA00599	2382	Brown	41	21.07	7.72	518	7.35	85.4	Clear	76-85	East	Light	Run
				7/12/00	9:40 AM	AA00695	846.4	Brown	27	19.01	7.91	687	7.97	89.8	Cloudy	61-75	East	Light	Run
				Geometric Mean			1648												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Dekalb 3	LEJ070-0008	St. Joseph River	SR 101 bridge, South of Newville	6/14/00	11:00 AM	AA00261	1732.87	Brown	156	21.84	7.54	369	6.59	77.6	Scattered	76-85	South	Light	Run
				6/21/00	10:35 AM	AA00323	1076	Brown	76	20.4	7.53	451	6.81	77.7	Cloudy	76-85	West	Moderate	Run
				6/29/00	10:35 AM	AA00512	378.4	Brown	54.5	20.6	7.56	364	6.55	75.2	Scattered	76-85	West	Mod./Light	Run
				7/5/00	10:25 AM	AA00601	816.4	Brown	95	22.1	7.66	414	6.43	76	Scattered	76-85	East	Calm	Run
				7/12/00	10:25 AM	AA00699	146.7	Brown	55	20.73	7.77	591	7.26	83.6	Scattered	76-85	East	Calm	Run
				Geometric Mean						610									
Dekalb 4	LEJ080-0004	Cedar Creek	Walking bridge Eckhart Park, Auburn, Northeast of Swimming Pool	6/14/00	1:00 PM	AA00256	2202.7	Brown	43.4	23.96	7.83	666	7.9	96.6	Scattered	76-85	North	Moderate	Riffle
				6/21/00	11:05 AM	AA00326	7701	Brown	165	19.36	7.43	534	7.72	86	Scattered	61-75	East	Moderate	Riffle
				6/29/00	11:05 AM	AA00513	686.7	Green	13.2	19.07	7.6	651	7.78	86.6	Scattered	76-85	South	Light	Riffle
				7/5/00	10:55 AM	AA00602	1374	Brown	21	21.72	7.79	679	7.55	88.8	Scattered	76-85	East	Calm	Riffle
				7/12/00	12:00 PM	AA00700	648.8	Clear	5	20.4	7.88	751	8.8	98.8	Scattered	76-85	East	Light	Riffle
				Geometric Mean						1597									
Dekalb 5	LEJ090-0009	Cedar Creek	Wayne St. bridge (CR 427), South of Auburn, at 56th Road	6/14/00	1:40 PM	AA00258	2419.2	Brown	61	22.09	7.86	712	8.29	98.2	Rain	61-75	North	Light	Run
				6/21/00	11:20 AM	AA00327	17329	Brown	171	19.57	7.33	578	7.79	87.2	Ptly Cloudy	76-85	West	Moderate	Run
				6/29/00	11:20 AM	AA00515	598.15	Brown	15	19.18	7.67	702	7.98	89.5	Scattered	76-85	West	Mod./Light	Run
				7/5/00	11:10 AM	AA00604	1732.87	Brown	9	22.13	7.84	738	7.62	90.3	Scattered	76-85	East	Light	Run
				7/12/00	12:10 PM	AA00701	727	Clear	5	20.85	7.92	850	9.3	107.5	Scattered	76-85	East	Light	Run
				Geometric Mean						1995									

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County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Dekalb 6	LMJ110-0007	Story Lake	DNR boat ramp, West of 11th Rd	6/13/00	3:45 PM	AA00246	137.4	Green	12.9	25.05	8.5	422	10.1	125.1	Rain	61-75	South	Mod./Light	lake
				6/20/00	3:07 PM	AA00314	16	Clear	10	25	8.41	457	11.04	136.5	Cloudy	76-85	East	Mod./Light	lake
				6/28/00	3:05 PM	AA00485	109.55	Clear	9.4	25.1	8.65	455	12.01	148.5	Cloudy	76-85	North	Light	lake
				7/4/00	3:00 PM	AA00590	26.2	Green	4	28.79	8.54	420	10.79	142.9	Scattered	76-85	South	Light	lake
				7/11/00	3:25 PM	AA00686	12	Green	10	26.8	8.46	446	10.46	135	Scattered	76-85	South	Light	lake
				Geometric Mean			38												
Lagrange 1	LMJ090-0007	Fawn River	CR 600 W, North of CR 700 N, East of Scott	9/26/00	9:55 AM	AA02054	96	Clear	0.5	12.33	8.19	612	10.3	99.8	Clear	61-75	North	Mod./Light	Run
				10/2/00	6:05 PM	AA02206	60.9	Clear	0.5	19.13	8.28	613	10.72	119.7	Scattered	61-75	West	Calm	Run
				10/10/00	5:55 PM	AA02571	71.2	Clear	1	11.88	8.29	593	12.07	113.8	Clear	46-60	West	Calm	Run
				10/16/00	5:40 PM	AA02825	63.8	Clear	1.5	15.37	8.22	605	10.86	110.8	Cloudy	46-60	East	Light	Run
				10/23/00	5:15 PM	AA02965	52.1	Clear	0.5	15.43	8.09	630	10.4	105.6	Cloudy	61-75	North	Light	Run
				Geometric Mean			67												
Lagrange 2	LMJ110-0009	Pigeon River	bridge above Dam at Mongo	6/13/00	2:20 PM	AA00239	488.4	Green	11.5	23.69	7.72	589	7.2	87.5	Ptly Cloudy	76-85	South	Light	Pool
				6/20/00	12:55 PM	AA00307	82	Clear	5	21.5	7.73	654	7.44	87.5	Cloudy	61-75	South	Mod./Light	Pool
				6/28/00	12:40 PM	AA00476	119.8	Clear	4	21.25	7.74	624	7.16	83.4	Ptly Cloudy	76-85	West	Light	Pool
				7/4/00	12:35 PM	AA00580	129.6	Clear	2	23.96	7.74	619	6.67	81.5	Ptly Cloudy	76-85	North	Calm	Pool
				7/11/00	1:00 PM	AA00679	166.4	Clear	2.4	23.14	7.81	656	7.3	88.3	Clear	76-85	South	Light	Pool
				Geometric Mean			160												

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Lagrange 3	LMJ120-0009	Pigeon River	CR 675 at Scott (Game Preserve)	9/26/00	9:40 AM	AA02052	101	Clear	0.8	12.98	8.21	594	9.9	98	Clear	46-60	West	Light	Run
				10/2/00	5:50 PM	AA02204	45	Clear	0	17.73	8.04	602	9.4	102.6	Clear	61-75	West	Light	Run
				10/10/00	5:45 PM	AA02569	57.3	Clear	1	10.58	8.06	595	10.8	99	Clear	46-60	West	Light	Riffle
				10/16/00	5:30 PM	AA02823	12.2	Clear	1	14.62	8.18	608	9.76	97.8	Cloudy	46-60	East	Light	Run
				10/23/00	5:05 PM	AA02963	27.25	Clear	0	15.24	7.93	631	9.17	94.4	Cloudy	61-75	North	Calm	Run
				Geometric Mean						39									
Lagrange 4	LMJ120-0011	Pigeon River	Onterio bridge, between CR 325 and 330 E North of 400 N	6/13/00	2:00 PM	AA00236	1553.07	Clear	11.7	23.21	7.76	545	7.85	94.2	Ptly Cloudy	76-85	South	Calm	Run
				6/20/00	12:35 PM	AA00305	45.35	Clear	6	22.08	7.78	640	8.2	96.8	Cloudy	76-85	South	Mod./Strong	Run
				6/28/00	12:20 PM	AA00475	90.9	Clear	5	21.37	7.73	606	8.06	94	Scattered	76-85	West	Calm	Run
				7/4/00	12:15 PM	AA00579	131.9	Clear	5	23.8	7.83	600	7.69	93.7	Scattered	> 86	South	Calm	Run
				7/11/00	12:30 PM	AA00678	172.3	Other	5	23.01	7.85	647	8.09	97.5	Clear	76-85	South	Light	Run
				Geometric Mean						171									
Lagrange 5	LMJ120-0012	Fly Creek	CR 150 N, West of CR 200 E	6/13/00	11:30 AM	AA00235	2419.2	Clear	11.1	20.76	7.95	688	9.01	103.7	Scattered	76-85	South	Light	Run
				6/20/00	12:15 PM	AA00336	2419.2	Clear	1.2	18.56	8.05	753	11.3	123.4	Cloudy	61-75	South	Mod./Light	Run
				6/28/00	12:05 PM	AA00474	920.8	Clear	8.5	17.31	7.91	727	10.65	115.1	Scattered	76-85	West	Calm	Run
				7/4/00	12:00 PM	AA00578	488.4	Clear	7	19.4	8.04	723	10.44	117	Ptly Cloudy	76-85	South	Calm	Run
				7/11/00	12:15 PM	AA00676	670	Clear	2	20.4	8.06	765	10.77	124.1	Clear	76-85	South	Light	Run
				Geometric Mean						1120									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Lagrange 6	LMJ120-0015	Fly Creek	US 20 bridge, East of LaGrange	6/13/00	1:30 PM	AA00260	2419.2	Clear	99.9	24.87	7.85	626	8.97	103.3	Cloudy	76-85	South	Light	Riffle
				6/20/00	12:05 PM	AA00303	2419.2	Clear	2	18.31	7.9	704	10.73	118	Cloudy	61-75	South	Moderate	Riffle
				6/28/00	11:00 AM	AA00472	1732.87	Clear	0.9	16.61	7.78	701	10.42	111.6	Scattered	76-85	West	Light	Riffle
				7/4/00	10:50 AM	AA00577	2419.2	Clear	5	19.08	7.89	683	10.32	115.6	Ptly Cloudy	76-85	South	Calm	Riffle
				7/11/00	11:15 AM	AA00674	2419.2	Clear	5	19.47	7.95	715	10.85	123.2	Clear	76-85	South	Light	Riffle
				Geometric Mean						2263									
Lagrange 7	LMJ120-0013	Fish Lake	DNR boat ramp, CR 500 E., South of US 20.	6/13/00	11:30 AM	AA00234	142.1	Green	11.5	25.76	8.17	476	8.75	110.5	Scattered	76-85	East	Light	lake
				6/20/00	10:45 AM	AA00302	49.6	Clear	3.5	24.38	7.73	482	6.22	78.5	Ptly Cloudy	76-85	South	Mod./Light	lake
				6/28/00	10:40 AM	AA00469	13.4	Clear	1.9	23.55	8.4	446	9.63	117	Ptly Cloudy	61-75	East	Light	lake
				7/4/00	10:35 AM	AA00576	19.7	Clear	3	25.87	8.23	422	8.58	108.6	Ptly Cloudy	76-85	South	Calm	lake
				7/11/00	11:00 AM	AA00673	68.9	Clear	13	25.72	8.25	444	9.45	119.3	Clear	76-85	South	Light	lake
				Geometric Mean						42									
Lagrange 8	LMJ120-0014	Shipshawana Lake	DNR boat ramp, CR 280 N, West of CR 900 W	9/26/00	9:20 AM	AA02053	3.1	Green	14.5	14.18	9.6	362	11.03	110.9	Clear	46-60	West	Light	lake
				10/2/00	5:20 PM	AA02207	11	Green	10	18.8	9.14	371	11.84	131.6	Clear	76-85	West	Light	lake
				10/10/00	5:25 PM	AA02568	2	Brown	20	11.64	9.04	377	11.53	107.9	Clear	46-60	West	Mod./Light	lake
				10/16/00	5:00 PM	AA02822	2	Murky	15	15.04	9.09	392	11.43	115.5	Cloudy	46-60	East	Light	lake
				10/23/00	4:30 PM	AA02962	1	Murky	9	16.22	8.94	416	11.66	120	Cloudy	61-75	North	Calm	lake
				Geometric Mean						3									

APPENDIX A

Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Steuben 1	LMJ090-0004	Crooked Creek	Bridge 120, East of 327 at Orland	6/13/00	2:47 PM	AA00241	2419.17	Green	13	25.11	7.74	503	7.03	87.4	Ptly Cloudy	76-85	South	Light	Run
				6/20/00	2:00 PM	AA00308	228	Clear	4	23.57	7.69	525	7.46	90	Cloudy	76-85	South	Mod./Light	Run
				6/28/00	1:45 PM	AA00477	920.8	Clear	2.5	22.8	7.54	504	6.3	75.5	Cloudy	76-85	West	Light	Run
				7/4/00	1:40 PM	AA00583	1209.7	Clear	3	26.13	7.59	485	5.8	73.9	Scattered	> 86	South	Light	Run
				7/11/00	2:00 PM	AA00680	1046.24	Brown	3	25.73	7.73	528	6.96	88	Clear	76-85	South	Light	Run
				Geometric Mean						915									
Steuben 2	LMJ110-0006	Pigeon Creek	US 20, West of CR 600 W. Near Angola Airport	6/13/00	4:15 PM	AA00243	203.55	Clear	11.2	23.09	7.92	654	8.47	102	Rain	61-75	South	Mod./Light	Run
				6/20/00	2:00 PM	AA00313	33.2	Clear	4	23.4	8.06	688	10.36	124.4	Cloudy	61-75	East	Mod./Strong	Run
				6/28/00	2:30 PM	AA00482	26.9	Clear	1.5	23.57	7.98	660	8.8	107	Cloudy	76-85	West	Light	Run
				7/4/00	2:20 PM	AA00586	39.1	Clear	2	26.2	7.87	672	8.31	105.9	Scattered	> 86	South	Light	Run
				7/11/00	2:50 PM	AA00684	56.3	Clear	1	25	7.81	704	7.8	97.6	Scattered	76-85	South	Light	Run
				Geometric Mean						53									
Steuben 3	LMJ110-0010	Pigeon River	Boat Ramp on SR 327, 1/4 mile North of US 20	6/13/00	3:00 PM	AA00240	203.5	Green	30.5	23.44	7.92	637	7.92	95.8	Cloudy	76-85	South	Mod./Light	Run
				6/20/00	2:15 PM	AA00309	75.4	Clear	3	22.5	7.92	682	8.72	102.9	Cloudy	61-75	East	Mod./Strong	Run
				6/28/00	2:00 PM	AA00481	93.3	Clear	2.5	22.91	7.9	663	7.74	92.9	Cloudy	76-85	West	Light	Run
				7/4/00	2:05 PM	AA00585	69.1	Green	2	24.7	7.85	651	7.39	91.9	Scattered	> 86	South	Light	Run
				7/11/00	2:15 PM	AA00681	111.9	Green	1	24.19	7.85	698	7.63	93.9	Ptly Cloudy	76-85	South	Light	Run
				Geometric Mean						102									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Steuben 4	LMJ110-0012	Pigeon Creek	Bill Deller Road	6/13/00	4:53 PM	AA00247	2419.2	Green	26.3	20.92	7.37	576	5.66	65.3	Cloudy	61-75	North	Mod./Light	Run
				6/20/00	4:00 PM	AA00315	298	Brown	7.7	20.9	7.58	710	7.95	93	Cloudy	76-85	South	Mod./Strong	Run
				6/28/00	3:55 PM	AA00489	206.3	Green	9	20.28	7.47	617	6.99	79.8	Ptly Cloudy	76-85	West	Light	Run
				7/4/00	3:40 PM	AA00592	2419.17	Green	14	22.79	7.58	580	6.96	83.5	Scattered	> 86	South	Calm	Run
				7/11/00	4:20 PM	AA00688	59.3	Green	15	23.1	7.7	696	7.87	95	Ptly Cloudy	76-85	South	Light	Run
				Geometric Mean			463												
Steuben 5	LMJ110-0014	Pigeon Creek	CR 400 S, East of Old Hwy 27	6/13/00	4:45 PM	AA00255	2419.2	Brown	26.7	21.1	7.43	597	6.18	71.6	Cloudy	61-75	South	Light	Run
				6/20/00	3:45 PM	AA00316	364	Brown	12.6	20.66	7.59	773	7.84	91.7	Cloudy	76-85	East	Moderate	Run
				6/28/00	3:50 PM	AA00487	435.2	Brown	18	20.06	7.51	652	7.38	84.5	Ptly Cloudy	61-75	West	Mod./Light	Riffle
				7/4/00	3:30 PM	AA00591	2419.17	Brown	22	23.34	7.66	600	7.37	89.4	Scattered	> 86	South	Calm	Run
				7/11/00	4:10 PM	AA00687	387.3	Brown	15	22.73	7.73	823	7.53	90.8	Scattered	76-85	South	Light	Riffle
				Geometric Mean			815												
Steuben 6	LMJ110-0011	Turkey Creek	Bridge on SR 327, at Turkey Creek Rd	6/13/00	3:20 PM	AA00244	88	Green	19.2	23.24	7.85	654	7.91	95.2	Mist	61-75	South	Light	Run
				6/20/00	2:55 PM	AA00310	47.2	Green	3	22.61	7.9	650	9.61	114.1	Cloudy	76-85	East	Mod./Light	Run
				6/28/00	2:50 PM	AA00484	76.6	Clear	6.2	22.17	7.85	631	8.99	106.7	Cloudy	76-85	West	Light	Run
				7/4/00	2:40 PM	AA00587	920.8	Green	4	24.82	8.06	595	10.67	132.5	Scattered	> 86	South	Calm	Run
				7/11/00	3:10 PM	AA00685	129.6	Green	5	24	8.17	590	12.43	152.4	Scattered	76-85	South	Light	Riffle
				Geometric Mean			131												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Steuben 7	LEJ020-0001	Clear Lake	Public Beach, East end	6/14/00	8:50 AM	AA00248	1	Clear	5.1	23.15	8.41	337	8.6	103.3	Clear	76-85	West	Light	lake
				6/21/00	8:25 AM	AA00317	5.2	Clear	1.8	21.93	8.42	351	8.85	105	Mist	61-75	West	Moderate	lake
				6/21/00	7:45 AM	AA00318	2	Clear							Mist	61-75	West	Moderate	lake
				6/29/00	8:25 AM	AA00490	1	Clear	0.8	20.97	8.39	337	8.27	95.4	Scattered	61-75	West	Mod./Strong	lake
				7/5/00	8:15 AM	AA00593	2	Clear	5	24.55	8.31	336	7.95	98	Clear	76-85	South	Mod./Light	lake
				7/12/00	8:00 AM	AA00692	6.3	Clear											
				7/12/00	8:20 AM	AA00691	1	Clear											
				7/12/00	8:20 AM	AA00690	1	Clear	0.5	22.27	8.36	350	855	101.2	Ptly Cloudy	61-75	South	Calm	
				Geometric Mean			2												
Steuben 8	LEJ050-0009	Hamilton Lake	Public Beach, Lake Outlet	6/14/00	9:50 AM	AA00250	18.9	Clear	9.7	23.83	8.28	383	8.34	101.6	Scattered	76-85	North	Light	lake
				6/21/00	9:40 AM	AA00320	34.1	Clear	3.5	22.9	8.12	395	7.98	94.4	Mist	61-75	South	Mod./Strong	lake
				6/29/00	9:30 AM	AA00507	13.4	Green	14.8	23.05	8.25	382	7.96	95	Scattered	61-75	West	Mod./Light	lake
				7/5/00	9:15 AM	AA00597	27.5	Green	10	25.99	8.02	385	7.5	94.8	Scattered	76-85	East	Light	lake
				7/12/00	9:20 AM	AA00694	11	Clear	6	23.35	8.27	399	8.37	101.1	Cloudy	61-75	East	Light	lake
				Geometric Mean			19												
Steuben 9	LEJ050-0010	Fish Creek	CR 200 S, East of Metz	6/14/00	9:25 AM	AA00249	1986.28	Brown	24.4	18.75	7.37	585	7.54	83.5	Clear	76-85	North	Light	Run
				6/21/00	9:10 AM	AA00319	24191.1	Brown	84	18.1	7.2	527	7.34	80.3	Mist	61-75	South	Mod./Strong	Run
				6/29/00	9:00 AM	AA00491	816.4	Brown	11.5	17.22	7.26	657	7.55	82	Scattered	76-85	West	Mod./Light	Run
				7/5/00	8:50 AM	AA00594	2419.2	Brown	71	19.65	7.35	576	7.06	80.3	Scattered	76-85	East	Light	Run
				7/12/00	8:50 AM	AA00693	816.4	Brown	7	16.77	7.54	762	7.88	84.4	Cloudy	61-75	East	Light	Run
				Geometric Mean			2387												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Lake 1	LMG020-0016	Indiana Harbor Canal	bridge on SR 312, West of Water Tower	7/25/00	12:35 PM	AA00964	9.7	Clear	4	27.87	7.95	535	6.29	82	Ptly Cloudy	> 86	North	Light	Run
				7/31/00	4:00 PM	AA01083	94.65	Green	16	26.29	7.87	495	5.96	75.8	Cloudy	61-75	West	Light	Run
				8/7/00	3:40 PM	AA01452	686.7	Clear	10	28.47	8.07	494	7.22	95.8	Clear	76-85	South	Mod./Light	Run
				8/14/00	4:30 PM	AA01543	24	Clear	4	29.29	8.31	504	7.71	103.5	Clear	> 86	South	Mod./Light	Run
				8/21/00	3:15 PM	AA01704	23.1	Clear	6	26.74	8.27	540	7.72	98.3	Scattered	76-85	South	Moderate	Run
				Geometric Mean			51												
Lake 2	LMG030-0006	Turkey Creek	North of New Elliot, Narrow bridge	7/25/00	4:20 PM	AA00970	28.7	Murky	21	23.43	8.04	1036	8.2	99.1	Ptly Cloudy	76-85	West	Light	Run
				7/31/00	2:50 PM	AA01090	770.1	Clear	8	20.85	7.48	771	6.51	74.9	Mist	61-75	West	Mod./Light	Riffle
				8/7/00	2:40 PM	AA01447	2419.17	Brown	11	24.24	7.61	631	6.41	79.4	Scattered	76-85	South	Light	Riffle
				8/14/00	3:25 PM	AA01538	166.9	Clear	8	25.38	7.99	967	8.06	101.5	Clear	76-85	West	Mod./Light	Run
				8/21/00	2:10 PM	AA01699	178.5	Clear	6	22.2	7.87	825	7.72	91.4	Clear	76-85	South	Mod./Light	Run
				Geometric Mean			276												
Lake 3	LMG030-0007	Turkey Creek	SR 53 Broadway, South of 61st St	7/25/00	3:52 PM	AA00974	517.2	Murky	21	23.39	7.89	1230	6.98	84.3	Ptly Cloudy	76-85	West	Light	Run
				7/31/00	5:10 PM	AA01089	1046.24	Brown	24	21.19	7.78	914	6.26	73.1	Cloudy	61-75	West	Light	Run
				8/7/00	4:35 PM	AA01456	1986.28	Brown	32	26.1	7.83	693	6.52	83.9	Clear	> 86	South	Mod./Light	Run
				8/14/00	5:35 PM	AA01547	1299.65	Murky	13	25.8	7.98	1198	6.75	86.2	Clear	> 86	South	Mod./Light	Run
				8/21/00	4:25 PM	AA01708	697.9	Murky	20	22.3	7.97	1009	7.15	84.7	Scattered	76-85	South	Moderate	Run
				Geometric Mean			995												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Lake 4	LMG030-0008	Deep River	Festival Park in Hobart, Lake George	7/25/00	2:25 PM	AA00976	9.8	Clear	17	26.38	8.46	813	10.9	138.4	Scattered	76-85	North	Mod./Light	lake
				8/1/00	3:15 PM	AA01101	32.7	Brown	21	27.75	8.22	833	7.52	98.5	Scattered	76-85	West	Mod./Light	lake
				8/7/00	5:05 PM	AA01478	129.1	Brown	11	27.33	8.64	841	12.21	159.4	Clear	76-85	South	Mod./Light	lake
				8/15/00	3:15 PM	AA01571	30.1	Clear	18	29.28	8.82	766	14.93	200	Clear	> 86	South	Mod./Light	lake
				8/22/00	3:00 PM	AA01730	13.4	Green	14	25.37	8.6	760	12.36	154.3	Ptly Cloudy	76-85	South	Moderate	lake
				Geometric Mean						28									
Lake 5	LMG030-0009	Deep River	Deep River County Park, Foot bridge	7/25/00	5:20 PM	AA00977	435.2	Murky	11	21.11	7.96	805	8.2	95.8	Scattered	76-85	West	Calm	Run
				8/1/00	4:10 PM	AA01115	461.1	Brown	11	21.87	8.05	715	8.24	97.4	Ptly Cloudy	76-85	South	Light	Run
				8/7/00	5:45 PM	AA01483	2419.2	Brown	53	24.39	7.86	599	6.84	85	Clear	> 86	South	Light	Run
				8/15/00	4:20 PM	AA01574	920.8	Clear	11	24.63	8.09	792	7.69	95.7	Clear	> 86	South	Light	Run
				8/22/00	4:00 PM	AA01733	344.8	Murky	10	21.52	8.09	759	8.34	97.2	Ptly Cloudy	76-85	South	Mod./Light	Run
				Geometric Mean						688									
Lake 6	LMG030-0010	Deep River	Grand Blvd. bridge, 2 miles South of US 30	7/25/00	5:00 PM	AA00980	771.7	Murky	13	21.91	7.69	765	7.03	82.5	Ptly Cloudy	76-85	West	Light	Run
				8/1/00	3:55 PM	AA01091	770.1	Brown	18	22.61	7.77	737	6.69	80.2	Scattered	76-85	South	Light	Run
				8/7/00	5:30 PM	AA01480	2419.17	Brown	37	23.62	7.71	695	6.05	74.1	Clear	76-85	South	Light	Run
				8/15/00	4:00 PM	AA01573	435.2	Murky	18	25.24	7.85	761	6.73	84.5	Clear	> 86	South	Mod./Light	Run
				8/22/00	3:40 PM	AA01732	410.6	Murky	14	22.26	7.9	747	7.42	87.3	Cloudy	76-85	South	Mod./Light	Run
				Geometric Mean						762									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Lake 7	LMG030-0011	Deep River	61st Ave, West of SR 51, South of Hobart	7/25/00	3:35 PM	AA00971	261.3	Brown	12	21.43	7.96	766	8.6	99.8	Ptly Cloudy	76-85	North	Light	Run
				8/1/00	3:35 PM	AA01088	648.8	Green	16	22.37	7.94	713	7.63	91.2	Scattered	76-85	West	Mod./Light	Run
				8/7/00	4:50 PM	AA01479	920.8	Murky	36	22.89	7.93	695	7.31	88.3	Clear	> 86	South	Mod./Light	Run
				8/15/00	3:30 PM	AA01572	261.3	Murky	13	24.64	8.09	782	7.69	95.8	Clear	> 86	South	Mod./Light	Run
				8/22/00	3:15 PM	AA01731	323.75	Murky	27	21.59	8.07	724	8.1	95	Cloudy	76-85	South	Moderate	Run
				Geometric Mean						421									
Lake 8	LMG040-0004	Little Calumet	SR 53 bridge, South of I-80, Exit 10	7/25/00	1:45 PM	AA00973	10	Brown	30	27.13	8.42	1100	12.74	164.6	Ptly Cloudy	> 86	North	Light	Run
				7/31/00	4:55 PM	AA01085	1203.3	Brown	33	22.86	7.73	1033	5.88	72.1	Cloudy	61-75	West	Mod./Light	Run
				8/7/00	4:20 PM	AA01455	1413.6	Green	31	27.17	8.27	694	8.89	115.8	Clear	> 86	South	Mod./Light	Run
				8/14/00	5:20 PM	AA01546	101.7	Brown	31	28.11	8.25	805	9.62	127	Clear	76-85	West	Mod./Light	Run
				8/21/00	4:05 PM	AA01707	107.6	Green	42	24.72	8.34	834	10.38	127.5	Scattered	76-85	South	Mod./Light	Run
				Geometric Mean						179									
Lake 9	LMG040-0005	Burns Ditch	SR 51 bridge, North of I-94, Exit 15	7/24/00	2:15 PM	AA00975	270	Green	18.9	24.67	8.07	888	7.72	95.5	Clear	76-85	East	Light	Run
				8/1/00	2:45 PM	AA01103	980.4	Green	28	23.8	7.83	937	6.88	84.8	Scattered	76-85	South	Light	Run
				8/8/00	1:35 PM	AA01477	2419.2	Murky	18	25.28	7.93	790	6.75	85	Scattered	76-85	South	Mod./Light	Run
				8/15/00	2:55 PM	AA01570	201.4	Green	18	28.16	8.22	848	8.06	106.4	Clear	> 86	South	Mod./Light	Run
				8/22/00	2:35 PM	AA01729	387.3	Murky	23	24.45	8.14	814	8.24	101.4	Ptly Cloudy	76-85	South	Moderate	Run
				Geometric Mean						549									

APPENDIX A

Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Lake 10	UMC030-0005	Little Calumet River	Columbia Drive bridge, South of Riverside Drive.	7/25/00	11:45 AM	AA00968	3654	Murky	45	21.69	7.99	1540	8.65	101.7	Scattered	> 86	North	Calm	Run
				7/31/00	3:20 PM	AA01081	2419.2	Murky	17	21.05	7.72	917	7.2	83.6	Mist	61-75	West	Light	Run
				8/7/00	3:00 PM	AA01450	8164	Brown	148	23.32	7.82	611	7.22	88.2	Scattered	76-85	South	Light	Run
				8/14/00	3:55 PM	AA01541	1413.6	Clear	7	24.43	8.06	1314	8.27	102.6	Clear	> 86	West	Light	Run
				8/21/00	2:40 PM	AA01702	8164	Murky	18	21.78	8.02	1197	8.32	97.2	Clear	76-85	South	Moderate	Run
				Geometric Mean						3838									
Lake 11	UMC030-0007	Little Calumet River	SR 912 Southbound, South of I80-95 exit 5.	7/25/00	11:25 AM	AA00969	3654	Brown	25	22.74	7.74	1008	6.62	79	Scattered	> 86	North	Light	Run
				7/31/00	4:25 PM	AA01122	770.1	Brown	18	22.84	7.69	500	538	64.9	Cloudy	61-75	North	Mod./Light	Run
				8/7/00	3:55 PM	AA01453	1986.3	Brown	12	26.9	8.47	833	10.47	135.5	Clear	76-85	South	Mod./Light	Run
				8/14/00	4:50 PM	AA01544	2419.2	Murky	22	26.54	8.8	703	14.44	184.8	Clear	> 86	South	Mod./Light	Run
				8/21/00	3:30 PM	AA01705	5475	Green	14	23.34	7.87	873	6.29	75.7	Scattered	76-85	South	Moderate	Run
				Geometric Mean						2365									
Lake 12	UMC050-0004	Grand Calumet River	Columbia Street, between Columbia Park and WWTP	7/25/00	12:10 PM	AA00966	107.6	Clear	3	24.83	7.44	1290	9.17	113.7	Ptly Cloudy	> 86	North	Light	Pool
				7/31/00	3:44 PM	AA01082	365.4	Clear	6	22.72	7.27	1151	7.73	92.5	Mist	61-75	North	Mod./Light	Pool
				8/7/00	3:20 PM	AA01451	invalid test	Clear	10	27.74	7.79	867	9.59	126.1	Clear	76-85	South	Mod./Light	Pool
				8/14/00	4:15 PM	AA01542	488.4	Murky	5	27.89	8.19	1189	12.72	166.7	Clear	> 86	South	Mod./Light	Pool
				8/21/00	2:55 PM	AA01703	770.1	Other	4	25.93	7.7	1520	10.67	134.3	Scattered	76-85	South	Moderate	Pool
				Geometric Mean						349									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Laporte 1	LMG070-0005	Trail Creek	Liberty St. bridge, Michigan City	7/25/00	9:45 AM	AA00989	344.8	Murky	10	17.38	7.99	658	8.68	93	Clear	61-75	East	Calm	Run
				8/1/00	11:00 AM	AA01080	2419.2	Brown	34	19.73	8.01	539	8.13	91	Cloudy	76-85	South	Calm	Run
				8/8/00	10:50 AM	AA01467	1553.07	Green	11	21.12	8.09	649	8	93	Cloudy	76-85	South	Mod./Light	Run
				8/15/00	11:30 AM	AA01558	invalid test	Clear	5	20.86	8.16	635	8.4	97.1	Ptly Cloudy	76-85	South	Mod./Light	Run
				8/22/00	10:05 AM	AA01719	325.5	Clear	5	18.46	8.19	595	8.11	95.3	Scattered	76-85	South	Light	Riffle
				Geometric Mean						806									
Laporte 2	LMG070-0010	Trail Creek	Woziniak Rd, South of CR 400 N.	7/25/00	8:30 AM	AA00994	128.7	Clear	7	14.23	7.98	613	9.82	99.1	Scattered	61-75	East	Light	Riffle
				8/1/00	9:00 AM	AA01095	868.6	Murky	13	16.14	7.96	572	9.4	99.6	Ptly Cloudy	61-75	South	Light	Riffle
				8/8/00	9:20 AM	AA01462	248.1	Clear	9	17.17	8.08	621	9.39	101.6	Ptly Cloudy	61-75	South	Mod./Light	Run
				8/15/00	9:45 AM	AA01551	186	Clear	5	17.04	8.12	612	9.45	102.7	Scattered	76-85	South	Mod./Light	Run
				8/22/00	9:05 AM	AA01712	166.9	Clear	5	15.49	8.12	587	9.74	100.6	Clear	61-75	South	Mod./Light	Run
				Geometric Mean						244									
Laporte 3	LMG070-0011	Trail Creek	Old US 20 bridge South of SR 20, East of Johnson Rd.	7/25/00	9:10 AM	AA00990	866.4	Clear	10	15.96	7.98	625	8.96	93.3	Scattered	61-75	North	Mod./Light	Riffle
				8/1/00	9:15 AM	AA01097	2419.2	Brown	44	18.45	7.86	535	7.77	86.5	Ptly Cloudy	61-75	North	Light	Run
				8/8/00	9:35 AM	AA01463	1732.87	Clear	7	19.03	8.04	663	8.36	93.5	Ptly Cloudy	61-75	South	Mod./Light	Riffle
				8/15/00	10:00 AM	AA01554	260.2	Murky	6	19.54	8.14	612	8.47	95.4	Clear	76-85	South	Light	Riffle
				8/22/00	9:20 AM	AA01715	325.5	Murky	5	17.12	8.13	604	8.8	93.6	Clear	61-75	South	Light	Riffle
				Geometric Mean						790									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Laporte 4	LMG070-0017	Trail Creek	bridge on US 35	7/25/00	9:30 AM	AA00996	410.6	Clear	5	17.43	8.07	617	8.86	95.3	Scattered	61-75	North	Mod./Light	Riffle
				8/1/00	9:45 AM	AA01099	2419.2	Brown	48	18.89	7.97	566	8.08	90.5	Ptly Cloudy	76-85	South	Light	Riffle
				8/8/00	9:55 AM	AA01465	1299.65	Murky	8	20.79	8.14	611	8.22	94.9	Ptly Cloudy	61-75	West	Moderate	Run
				8/15/00	10:20 AM	AA01556	547.5	Clear	6	20.9	8.22	574	8.45	98	Scattered	> 86	West	Light	Riffle
				8/22/00	9:50 AM	AA01717	325.5	Clear	5	18.61	8.23	601	8.86	97.7	Clear	76-85	South	Mod./Light	Riffle
				Geometric Mean			745												
Laporte 5	LMG070-0018	Trail Creek	bridge on US 20	7/25/00	9:20 AM	AA00985	648.8	Clear	7	16.95	8.04	604	8.85	93.6	Scattered	61-75	North	Mod./Light	Riffle
				8/1/00	9:30 AM	AA01098	2419.2	Brown	60	18.89	7.94	567	8	88.9	Ptly Cloudy	76-85	South	Light	Run
				8/8/00	9:45 AM	AA01464	1119.85	Murky	13	20.32	8.12	605	8.26	94.4	Cloudy	61-75	West	Mod./Light	Run
				8/15/00	10:10 AM	AA01555	461.1	Murky	7	20.38	8.19	602	8.36	95.3	Scattered	76-85	West	Light	Run
				8/22/00	9:40 AM	AA01716	325.5	Murky	5	18.03	8.2	588	8.88	96	Scattered	61-75	South	Mod./Light	Run
				Geometric Mean			766												
Laporte 6	LMG100-0004	Galena River	CR 125 E bridge, North of CR 900 N	7/25/00	10:20 AM	AA00991	285.1	Clear	3	16.79	8.03	655	8.93	94.7	Clear	76-85	North	Light	Run
				8/1/00	10:35 AM	AA01102	920.8	Clear	8	18.32	8.05	586	8.46	93	Cloudy	76-85	South	Light	Run
				8/8/00	10:25 AM	AA01466	686.7	Clear	7	20.66	8.11	645	8.11	93.7	Ptly Cloudy	61-75	West	Light	Run
				8/15/00	11:05 AM	AA01557	547.5	Clear	3	20.81	8.18	620	8.33	96.3	Ptly Cloudy	76-85	South	Light	Run
				8/22/00	10:35 AM	AA01718	2419.2	Clear	4	18.31	8.2	606	8.75	95.7	Scattered	76-85	South	Light	Run
				Geometric Mean			751												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Porter 1	LMG050-0006	Salt Creek	US 20 bridge, Portage	7/24/00	2:55 PM	AA00983	488.4	Murky	44	20.3	8.06	879	8.94	102.2	Clear	76-85	East	Light	Run
				8/1/00	2:20 PM	AA01112	1986.12	Murky	22	21.01	8.12	816	8.13	94.6	Scattered	76-85	West	Light	Run
				8/8/00	1:10 PM	AA01472	1642.97	Green	14	22.99	8.09	805	7.6	91.6	Scattered	> 86	South	Mod./Light	Run
				8/15/00	2:35 PM	AA01565	435.2	Green	16	23.88	8.21	897	8.05	98.8	Clear	> 86	South	Mod./Light	Run
				8/22/00	2:15 PM	AA01725	816.4	Murky	18	20.93	8.18	818	8.45	97.3	Scattered	76-85	South	Moderate	Run
				Geometric Mean						892									
Porter 2	LMG050-0009	Salt Creek	CR 500 N bridge, East of 450 W, North of SR 130	7/25/00	5:40 PM	AA00984	387.3	Clear	6	21.13	8.13	928	8.56	99.1	Ptly Cloudy	76-85	West	Light	Run
				8/1/00	8:00 AM	AA01111	920.8	Clear	25	19.13	8.07	879	8.57	95.9	Ptly Cloudy	61-75	South	Light	Run
				8/8/00	8:05 AM	AA01457	1119.85	Brown	14	21.06	8.07	861	7.95	92.5	Ptly Cloudy	61-75	West	Moderate	Run
				8/15/00	8:40 AM	AA01548	845.45	Murky	11	21.06	7.89	950	8.09	93.8	Clear	76-85	South	Light	Run
				8/22/00	8:00 AM	AA01710	1553.07	Murky	18	18.49	8.14	891	8.52	93.2	Scattered	61-75	South	Light	Run
				Geometric Mean						879									
Porter 3	LMG060-0008	East Branch Little Calumet River	SR 149, South of US Hwy 12, NW of Porter	7/24/00	3:11 PM	AA00997	387.3	Green	18	20.57	7.98	728	8.35	95.9	Clear	76-85	East	Light	Pool
				8/1/00	2:10 PM	AA01105	920.8	Murky	13	20.82	8.03	709	7.96	92.4	Ptly Cloudy	76-85	South	Calm	Run
				8/8/00	1:00 PM	AA01471	1203.31	Murky	13	23.05	8.02	630	7.32	88.5	Scattered	76-85	West	Mod./Light	Run
				8/15/00	2:25 PM	AA01562	195.5	Murky	8	23.37	8.1	717	7.98	97	Clear	> 86	West	Light	Run
				8/22/00	1:50 PM	AA01724	124.6	Murky	8	20.73	8.11	721	8.47	97.3	Cloudy	76-85	South	Mod./Light	Run
				Geometric Mean						402									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Porter 4	LMG060-0009	East Branch Little Calumet River	Salt Creek Landing, SR 249 bridge, North of I-94 Exit 19	7/24/00	2:32 PM	AA00982	49.6	Green	8	24.94	8.17	531	8.15	103.3	Clear	76-85	East	Light	Run
				8/1/00	2:35 PM	AA01104	325.5	Murky	13	27.06	8.23	498	6.94	89.5	Ptly Cloudy	76-85	West	Light	Run
				8/8/00	2:20 PM	AA01476	461.1	Murky	7	27.16	8.18	519	6.62	85.7	Scattered	76-85	South	Moderate	Run
				8/15/00	2:45 PM	AA01566	90.6	Murky	10	29.09	8.23	506	6.98	93.1	Clear	> 86	South	Mod./Light	Run
				8/22/00	2:25 PM	AA01726	110.6	Green	6	25.84	8.21	518	7.5	94	Ptly Cloudy	76-85	South	Moderate	Run
				Geometric Mean						149									
Porter 5	LMG060-0011	Little Calumet River	CR 1300 N bridge West of CR 450 E	7/24/00	4:33 PM	AA00988	4352	Clear	7	17.5	8.03	637	9.28	100.2	Clear	76-85	North	Mod./Light	Run
				8/1/00	1:40 PM	AA01094	816.4	Green	8	18.78	7.99	639	9	101.1	Cloudy	76-85	South	Calm	Run
				8/8/00	11:25 AM	AA01470	920.8	Murky	6	19.16	8.15	655	8.6	96.2	Cloudy	61-75	West	Light	Run
				8/15/00	11:55 AM	AA01561	686.7	Murky	6	19.59	8.21	641	9.13	103	Scattered	> 86	South	Mod./Light	Run
				8/22/00	11:25 AM	AA01722	476.35	Murky	4	17.8	8.06	641	9.58	103.8	Clear	76-85	South	Mod./Light	Run
				Geometric Mean						1014									
Porter 6	LMG060-0025	Coffee Creek	Morgan Ave bridge next to park	7/25/00	4:15 PM	AA00998	209.8	Clear	5	19.66	8.08	687	8.43	94.6	Clear	76-85	North	Mod./Light	Run
				8/1/00	11:35 AM	AA01110	648.8	Green	17	20.07	8.13	650	8.26	94.3	Ptly Cloudy	76-85	South	Calm	Run
				8/8/00	11:45 AM	AA01469	488.4	Murky	20	21.39	8.14	665	7.7	89.8	Cloudy	61-75	South	Moderate	Run
				8/15/00	12:20 PM	AA01560	461.1	Murky	8	23.83	8.24	677	8.16	100.4	Scattered	> 86	South	Mod./Light	Run
				8/22/00	11:50 AM	AA01721	344.8	Green	5	19.94	8.23	668	8.75	98.6	Cloudy	76-85	South	Light	Run
				Geometric Mean						403									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Porter 7	UMK090-0026	Long Lake	Public Access, Long Lake Rd. DNR Boat ramp	7/24/00	5:10 PM	AA00987	22.8	Clear	6	25.84	8.33	235	9.6	119.8	Clear	76-85	North	Mod./Light	Lake
				8/1/00	8:20 AM	AA01087	25	Green	22	23.67	7.43	237	5.13	62.1	Scattered	61-75	South	Mod./Light	Lake
				8/8/00	8:35 AM	AA01458	38.95	Green	6	25.16	7.6	250	5.89	73.5	Ptly Cloudy	61-75	West	Moderate	Lake
				8/15/00	9:08 AM	AA01550	23.8	Green	3	25.93	7.81	248	6.62	83.4	Clear	76-85	South	Light	Lake
				8/22/00	8:25 AM	AA01711	2	Clear	3	23	7.74	245	6.59	77.8	Ptly Cloudy	61-75	South	Mod./Light	Lake
				Geometric Mean			16												
St. Joseph 1	LMJ240-0005	Willow Creek	Jefferson St. in Powerline Easement	9/26/00	2:30 PM	AA02064	532.35	Clear	0.8	14.67	7.51	539	14.88	108.5	Clear	61-75	South	Moderate	Riffle
				10/4/00	11:00 AM	AA02217	2419.2	Clear	2	12.83	7.53	471	9.64	94.8	Cloudy	46-60	North	Light	Riffle
				10/11/00	11:05 AM	AA02583	688.7	Clear	1	9.78	7.8	536	11.32	102	Clear	61-75	West	Light	Riffle
				10/17/00	11:00 AM	AA02836	727	Clear	1.2	12.35	7.87	545	10.36	99	Cloudy	46-60	North	Calm	Run
				10/24/00	10:55 AM	AA03033	517.2	Clear	1	15	7.81	544	8.94	90.1	Cloudy	61-75	North	Calm	Run
				Geometric Mean			803												
St. Joseph 2	LMJ240-0007	St Joseph River	SR 219, Osceola	9/26/00	2:10 PM	AA02063	24.9	Brown	0.9	15.75	8.15	549	8.92	92.9	Scattered	61-75	West	Moderate	Run
				10/3/00	10:05 AM	AA02216	110.6	Brown	2	16.98	8.01	552	9.03	96.5	Cloudy	46-60	North	Light	Run
				10/11/00	10:15 AM	AA02579	32.7	Murky	2	11.18	8.16	547	10.54	98.2	Clear	61-75	West	Moderate	Run
				10/17/00	10:15 AM	AA02832	19.9	Murky	2.4	14.44	8.14	565	9.58	95.6	Cloudy	46-60	North	Light	Run
				10/24/00	10:10 AM	AA02975	44.1	Clear	2	15.39	7.9	5.9	8.92	90.7	Cloudy	61-75	North	Calm	Run
				Geometric Mean			38												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
St. Joseph 3	LMJ240-0018	St. Joseph River	End of race, Madison St. North of Niles St., West of Colfax, pier	9/26/00	3:20 PM	AA02071	344.8	Brown	4.1	16.6	8.15	554	9.33	99	Scattered	61-75	West	Moderate	Eddy
				10/3/00	12:00 PM	AA02221	2419.2	Brown	2.2	16.64	8.04	547	9.85	104.9	Cloudy	46-60	North	Mod./Light	Run
				10/11/00	12:10 PM	AA02586	72.8	Murky	3	12.41	8.23	539	11.8	113	Clear	61-75	West	Light	Eddy
				10/17/00	12:00 PM	AA02840	22.6	Murky	5	14.48	8.18	566	10.03	100.5	Ptly Cloudy	61-75	North	Calm	Eddy
				10/24/00	11:40 AM	AA02976	2419.17	Murky	4	16.16	7.99	594	9.57	98.6	Cloudy	61-75	North	Calm	Eddy
				Geometric Mean						319									
St. Joseph 4	LMJ240-0019	St. Joseph River	Riverside Dr. at end of race	9/26/00	3:25 PM	AA02068	261.3	Murky	4	16.5	8.14	560	947	99.8	Clear	61-75	West	Mod./Light	Eddy
				10/4/00	11:45 AM	AA02223	2419.2	Green	4.3	16.5	7.95	552	9.38	99.3	Cloudy	61-75	East	Calm	Run
				10/11/00	11:50 AM	AA02585	37.4	Murky	3.7	11.86	8.09	550	10.96	103	Clear	61-75	West	Mod./Light	Run
				10/17/00	11:45 AM	AA02839	30.5	Murky	5	14.68	8.16	572	10.2	102.4	Ptly Cloudy	61-75	North	Calm	Eddy
				10/24/00	11:55 AM	AA02977	2419.2	Murky	7	15.86	7.94	599	9.62	98.5	Cloudy	61-75	North	Calm	Eddy
				Geometric Mean						281									
St. Joseph 5	LMJ240-0021	Juday Creek	Grape Rd. South of Douglas	10/4/00	11:20 AM	AA02220	204.6	Clear	1	13.3	7.65	685	8.39	83.1	Cloudy	46-60	North	Light	Riffle
				10/11/00	11:25 AM	AA02580	197.4	Clear	2	10.58	7.85	731	9.94	91.7	Clear	61-75	West	Mod./Light	Riffle
				10/17/00	11:20 AM	AA02837	377.7	Clear	2	12.7	7.94	731	9.14	88.2	Cloudy	61-75	North	Light	Run
				10/24/00	11:15 AM	AA03035	1203.3	Clear	1	14.71	7.7	800	8.08	81.4	Cloudy	61-75	North	Calm	Run
				10/26/00	2:50 PM	AA02067	687.7	Clear	4	13.7	8	740	9.31	94.1	Clear	76-85	West	Moderate	Riffle
				Geometric Mean						417									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Elkhart 1	LMJ130-0001	St. Joseph River	US 80/90 bridge	9/26/00	11:35 AM	AA02075	48	Clear	0.6	14.54	8.19	521	9.26	94.8	Scattered	61-75	West	Mod./Light	Run
				10/3/00	9:00 AM	AA02433	290.9	Clear	0.6	15.65	7.94	513	8.43	87	Cloudy	46-60	North	Mod./Light	Run
				10/11/00	9:10 AM	AA02566	11	Clear	2	9.94	8.12	525	10.45	94.4	Clear	46-60	West	Light	Run
				10/17/00		no sample													
				10/24/00		no sample													
				Geometric Mean			54												
Elkhart 2	LMJ140-0005	Little Elkhart River	River Bend Park, Warren St.(CR16) East of SR 13	9/26/00	10:25 AM	AA02056	1986.28	Clear	0.3	10.23	8.75	678	10.47	97	Clear	61-75	North	Mod./Light	Run
				10/2/00	6:32 PM	AA02209	1553	Clear	0.4	17.72	7.97	671	8.22	89.4	Clear	61-75	West	Light	Riffle
				10/10/00	6:25 PM	AA02572	1119.85	Clear	2	11.42	8.03	681	9.93	92.7	Clear	46-60	West	Light	Riffle
				10/16/00	6:10 PM	AA02826	1119.85	Clear	6.5	14.45	8.12	675	9.31	93.3	Cloudy	46-60	East	Light	Run
				10/23/00	5:45 PM	AA02966	920.8	Clear	1	14.75	7.91	695	9.01	90.2	Cloudy	61-75	North	Calm	Run
				Geometric Mean			1289												
Elkhart 3	LMJ140-0013	Little Elkhart River	Bonneville Mill Park, CR 33, South of SR 120, Foot bridge	9/26/00	11:10 AM	AA02057	1299.65	Clear	0.3	11.36	8.75	670	10.65	102.4	Scattered	61-75	West	Mod./Light	Riffle
				10/4/00	8:35 AM	AA02210	2419.2	Clear	2.3	13.82	7.91	613	8.83	88.8	Cloudy	46-60	North	Calm	Run
				10/11/00	8:35 AM	AA02573	272.3	Clear	3	8.52	8.1	674	10.71	93.5	Clear	46-60	West	Light	Run
				10/17/00	9:15 AM	AA02828	435.2	Clear	1.8	13.12	8.13	665	9.51	92.3	Cloudy	46-60	North	Light	Riffle
				10/24/00	9:00 AM	AA02973	648.8	Clear	1	14.9	7.89	690	8.63	86.5	Cloudy	61-75	North	Calm	Run
				Geometric Mean			753												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Elkhart 4	LMJ150-0007	Pine Creek	CR 17, South of SR 120	9/26/00	11:55 AM	AA02058	648.8	Clear	1.8	12.64	8.24	671	10.9	107	Scattered	61-75	West	Moderate	Riffle
				10/4/00	9:30 AM	AA02211	2419.2	Clear	4.2	12.78	7.78	530	8.81	86.2	Cloudy	46-60	North	Mod./Light	Riffle
				10/11/00	9:30 AM	AA02575	248.9	Clear	1.5	8.29	7.97	688	11.05	96.4	Clear	46-60	West	Mod./Light	Run
				10/17/00	8:55 AM	AA02830	206.3	Clear	4.3	12.16	7.99	662	9.32	89.3	Cloudy	46-60	North	Light	Run
				10/24/00	1:15 PM	AA02970	224.7	Clear	1	15.74	7.89	673	9.77	100.5	Ptly Cloudy	61-75	North	Calm	Run
				Geometric Mean						448									
Elkhart 5	LMJ160-0002	Christiana Creek	CR 6 bridge, West of SR 19, North of Elkhart	9/25/00	1:10 PM	AA02059	49	Clear	0.3	15.85	8.61	450	11.98	125	Clear	61-75	East	Moderate	Run
				10/3/00	9:45 AM	AA02212	387.3	Clear	0	15.15	7.95	438	9.03	92.5	Cloudy	46-60	North	Light	Run
				10/11/00	9:55 AM	AA02578	40.8	Clear	1	11.24	8.21	456	10.97	102.1	Clear	46-60	West	Light	Riffle
				10/17/00	10:00 AM	AA02831	34.5	Clear	1.1	13.59	8.23	461	10.14	99.3	Cloudy	46-60	North	Light	Riffle
				10/24/00	9:50 AM	AA02974	77.6	Clear	0.5	15.58	7.92	480	8.69	89.2	Cloudy	61-75	East	Calm	Run
				Geometric Mean						73									
Elkhart 6	LMJ190-0006	Elkhart River	SR 33 bridge, near Benton	9/25/00	5:40 PM	AA02074	2419.2	Clear	0.6	13.15	8.33	590	10.03	97.8	Cloudy	46-60	East	Light	Run
				10/3/00	6:30 PM	AA02230	141.4	Clear	0.2	17.57	8.15	612	9.7	104.7	Scattered	46-60	East	Light	Run
				10/12/00	8:05 AM	AA02600	206.3	Clear	2	9.13	7.87	618	10.16	90.6	Clear	33-45	West	Calm	Run
				10/18/00	8:10 AM	AA02844	325.5	Murky	4.9	12.64	7.95	605	8.94	86	Mist	33-45	North	Calm	Run
				10/25/00	8:00 AM	AA02979	163.1	Clear	1.5	15.61	7.73	6.44	7.12	74.5	Fog	46-60	North	Calm	Pool
				Geometric Mean						327									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Elkhart 7	LMJ200-0014	Turkey Creek	SR 6 bridge, West of SR 15, North of Milford	9/25/00	5:05 PM	AA02040	290.9	Clear	0.5	12.03	7.98	729	9.38	89.8	Cloudy	46-60	North	Mod./Light	Run
				10/2/00	4:30 PM	AA02193	238.2	Clear	1	17.82	7.88	760	9.67	105.4	Clear	76-85	West	Mod./Light	Run
				10/10/00	4:30 PM	AA02565	155.3	Clear	11	11.36	7.85	750	10.84	101.4	Clear	61-75	West	Mod./Light	Run
				10/16/00	4:00 PM	AA02821	686.7	Clear	2.2	14.55	7.98	757	10.15	102.2	Cloudy	61-75	East	Mod./Light	Run
				10/23/00	3:35 PM	AA02960	131.7	Clear	2	14.81	7.78	793	9.9	99.7	Cloudy	61-75	North	Light	Run
				Geometric Mean						250									
Elkhart 8	LMJ210-0002	Yellow Creek	CR 13 bridge	9/26/00	4:55 PM	AA02073	461.1	Clear	2	12.52	8.1	717	11.03	107	Scattered	46-60	West	Mod./Light	Riffle
				10/4/00	1:55 PM	AA02226	2419.2	Brown	5	13.9	7.68	605	8.43	85.9	Cloudy	61-75	North	Mod./Light	Run
				10/11/00	1:40 PM	AA02587	770.1	Clear	7	10.44	7.25	757	10.86	99.5	Clear	61-75	West	Mod./Light	Run
				10/17/00	8:35 AM	AA02842	816.4	Clear	5	12.87	7.78	726	6.88	66.7	Cloudy	46-60	North	Calm	Run
				10/24/00	8:20 AM	AA02969	2419.2	Clear	1.6	14.53	7.62	741	5.94	59.7	Mist	61-75	North	Calm	Riffle
				Geometric Mean						1112									
Elkhart 9	LMJ210-0007	Elkhart River	River Avenue bridge, Goshen	9/26/00	5:15 PM	AA02072	131.7	Clear	3.4	14.36	8.14	656	9.87	99.7	Clear	46-60	West	Mod./Light	Run
				10/4/00	2:10 PM	AA02227	866.4	Murky	4.1	16.49	7.92	632	9.02	95.7	Cloudy	61-75	East	Light	Run
				10/11/00	1:55 PM	AA02588	98.7	Murky	3.6	11.33	7.98	660	10.89	101.4	Clear	61-75	West	Mod./Light	Run
				10/17/00	7:55 AM	AA02843	65	Clear	5.7	14.71	7.97	666	8.92	89.7	Cloudy	46-60	West	Light	Run
				10/24/00	8:00 AM	AA02967	71.1	Murky	3.3	15.13	7.77	689	8.39	84.9	Mist	61-75	North	Calm	Run
				Geometric Mean						139									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Elkhart 10	LMJ230-0005	Baugo Creek	CR 1, North of CR 24	9/26/00	4:30 PM	AA02069	2419.2	Clear	1.1	14.59	8.22	680	11.45	116.8	Scattered	61-75	West	Moderate	Run
				10/4/00	10:30 AM	AA02225	2419.2	Brown	4.2	14.1	7.84	618	8.25	83.2	Cloudy	61-75	North	Light	Riffle
				10/11/00	10:30 AM	AA02582	1413.6	Clear	2	8.79	7.89	648	10.51	92.9	Clear	61-75	West	Light	Run
				10/17/00	10:35 AM	AA02835	1299.65	Clear	2.2	12.83	7.89	694	8.35	82.6	Cloudy	46-60	North	Light	Run
				10/24/00	10:25 AM	AA03031	2419.2	Clear	2	14.88	7.66	717	7.03	70.5	Cloudy	61-75	North	Calm	Run
				Geometric Mean			1919												
Noble 1	LEJ090-0010	Little Cedar Creek	CR 300 South, East of SR 3	6/13/00	10:22 AM	AA00232	980	Clear	18.9	20.43	7.56	731	7.08	81.5	Ptly Cloudy	76-85	South	Light	Stagnant
				6/20/00	9:45 AM	AA00300	272.3	Brown	28	18.93	7.41	638	8.17	90.4	Ptly Cloudy	61-75	South	Mod./Light	Run
				6/28/00	9:30 AM	AA00465	538	Brown	17	18.13	7.36	600	7.88	86.4	Scattered	61-75	West	Light	Run
				7/4/00	9:30 AM	AA00572	2419.2	Murky	18	20.6	7.49	652	7.42	85.5	Ptly Cloudy	61-75	South	Calm	Run
				7/11/00	10:00 AM	AA00671	613.1	Brown	10	21.2	7.67	738	7.16	83.1	Scattered	76-85	South	Calm	Run
				Geometric Mean			734												
Noble 2	LMJ170-0010	Cree Lake	DNR boat ramp. East side of SR 3	6/13/00	10:50 AM	AA00233	172.3	Clear	27.1	25.07	8.32	477	8.75	109	Scattered	76-85	South	Light	lake
				6/20/00	10:15 AM	AA00301	3.1	Clear	1.4	24.2	8.26	482	9.76	118	Ptly Cloudy	76-85	South	Mod./Light	lake
				6/28/00	10:10 AM	AA00467	6.1	Clear	0.7	23.8	8.16	450	8.88	107.7	Ptly Cloudy	61-75	West	Light	lake
				7/4/00	10:10 AM	AA00574	16.8	Clear	3	25.72	8.27	454	8.67	108.8	Ptly Cloudy	76-85	South	Calm	lake
				7/11/00	10:35 AM	AA00672	11	Clear	2	25.55	8.26	472	9.03	113.6	Clear	76-85	South	Light	lake
				Geometric Mean			14												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Noble 3	LMJ170-0007	North Branch Elkhart River	At Cosperville, CR 900 N	9/27/00	10:00 AM	AA02049	272	Brown	3	13.38	8.05	524	8.07	79.2	Clear	61-75	West	Moderate	Run
				10/3/00	5:05 PM	AA02199	365.4	Green	2	19.57	8.02	530	8.52	96.5	Scattered	76-85	East	Calm	Run
				10/12/00	9:55 AM	AA02596	91.1	Brown	4	10.1	7.85	541	8.42	76.4	Clear	61-75	West	Light	Run
				10/18/00	10:15 AM	AA02854	135.4	Murky	8	12.66	8.28	534	10.22	98.4	Clear	46-60	North	Calm	Pool
				10/25/00	9:25 AM	AA02983	117.8	Murky	6	15.73	7.91	553	7.08	72.3	Cloudy	46-60	North	Calm	Pool
				Geometric Mean			171												
Noble 4	LMJ180-0006	Miller Lake	Chain O' Lakes S.P.first road on right, to boat ramps, Miller is on left	9/27/00	11:30 AM	AA02042	100	Clear	100	17.52	8.04	425	7.65	83.1	Clear	61-75	East	Moderate	Lake
				10/3/00	9:10 AM	AA02195	16.1	Clear	0	16.54	7.83	410	7.27	76.9	Mist	46-60	East	Moderate	Lake
				10/12/00	11:10 AM	AA02602	1	Clear	1.7	14.16	7.75	423	6.16	61.6	Clear	61-75	West	Mod./Light	Lake
				10/18/00	11:25 AM	AA02859	2	Clear	4	15.45	8.44	422	11.11	113.7	Clear	61-75	North	Calm	Lake
				10/25/00	10:45 AM	AA02990	5.2	Clear	3.5	10	8.33	440	10.05	102.9	Cloudy	46-60	North	Calm	Lake
				Geometric Mean			7												
Noble 5	LMJ180-0007	Sand Lake	Swimming Beach in Chain O' Lakes State Park	9/27/00	11:05 AM	AA02043	117	Clear	0.6	18.02	8.63	434	10.09	109.8	Clear	61-75	East	Mod./Light	Lake
				10/5/00	8:52 AM	AA02196	17.3	Clear	0.5	16.59	8.4	431	10.59	111.2	Mist	46-60	North	Moderate	Lake
				10/12/00	10:50 AM	AA02601	2	Clear	2	14.29	8.3	439	940	93.5	Clear	61-75	West	Mod./Light	Lake
				10/18/00	11:10 AM	AA02858	5.2	Clear	3	15.28	8.68	433	11.84	120.6	Clear	46-60	North	Calm	Lake
				10/25/00	10:30 AM	AA02989	6.95	Clear	2	16.06	8.65	444	12.39	127.8	Cloudy	61-75	North	Calm	Lake
				Geometric Mean			11												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Noble 6	LMJ180-0009	South Branch of Elkhart River	DNR boat ramp, SR 6, West of CR 450 W	9/27/00	9:40 AM	AA02045	319.25	Murky	7.7	12.85	8.07	603	9.19	89.3	Clear	46-60	West	Light	Run
				36802	4:50 PM	AA02198	160.7	Green	7	20.67	8	595	9.11	104.7	Clear	76-85	East	Calm	Run
				10/12/00	9:40 AM	AA02594	151	Murky	14	9.9	7.78	622	9.4	85.1	Clear	61-75	West	Calm	Run
				10/18/00	9:55 AM	AA02852	291.5	Murky	42	12.97	7.96	639	9.07	88	Clear	46-60	North	Calm	Run
				10/25/00	9:10 AM	AA02992	293.4	Murky	9	15.77	7.65	667	6.45	65.9	Cloudy	46-60	North	Calm	Run
				Geometric Mean						231									
Noble 7	LMJ180-0010	Croft Ditch	bridge downstream of Albion MWTP effluent drain	9/27/00	10:30 AM	AA02044	2419.2	Clear	3.1	13.65	8.17	731	12.2	121.3	Clear	61-75	West	Mod./Light	Run
				10/3/00	5:40 PM	AA02413	2419.2	Green	2	19.19	8.06	776	11.33	127.2	Scattered	61-75	East	Light	Run
				10/12/00	10:30 AM	AA02599	1733	Brown	3	10.16	7.98	753	12.09	109.6	Clear	61-75	West	Light	Run
				10/18/00	10:50 AM	AA02857	613.1	Murky	7	11.86	8.06	817	11.87	112.1	Clear	46-60	North	Calm	Run
				10/25/00	10:05 AM	AA02988	2419.17	Clear	1.3	14.91	7.68	810	8.03	80.5	Cloudy	61-75	North	Calm	Run
				Geometric Mean						1720									
Noble 8	LMJ180-0011	South Branch of Elkhart River	East of Albion River Road bridge	9/27/00	10:40 AM	AA02051	1203.31	Murky	6.9	14.7	7.88	552	7.38	75	Clear	61-75	West	Mod./Strong	Run
				10/3/00	5:30 PM	AA02436	166.4	Brown	4	18.29	7.8	562	7.79	86.2	Clear	61-75	East	Calm	Run
				10/12/00	10:20 AM	AA02597	770	Brown	4	10.69	7.61	593	6.25	57.4	Clear	61-75	West	Moderate	Pool
				10/18/00	10:35 AM	AA02855	143.9	Clear	3	12.67	7.63	618	7.09	68.2	Clear	46-60	North	Calm	Run
				10/25/00	9:55 AM	AA02987	613.1	Murky	3	15.39	7.48	654	4.48	45.4	Cloudy	61-75	North	Calm	Run
				Geometric Mean						423									

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Noble 9	LMJ190-0008	Elkhart River	SR 5 bridge in Ligonier	9/27/00	9:25 AM	AA02050	435.2	Brown	3.7	13.07	8.07	587	8.88	87.3	Clear	46-60	South	Moderate	Run
				10/3/00	4:30 PM	AA02202	209.8	Brown	3	18.5	7.97	584	9.57	106.8	Scattered	76-85	East	Calm	Run
				10/12/00	9:15 AM	AA02593	108.6	Clear	5	9.9	7.87	562	9.52	86.1	Clear	46-60	West	Light	Riffle
				10/16/00	4:30 PM	AA02850	235.90	Murky	5.5	15.15	8.15	575	9.96	101.1	Cloudy	46-60	East	Light	Run
				10/23/00	4:00 PM	AA02961	326	Clear	4	15.49	7.78	619	8.4	85.7	Cloudy	61-75	North	Calm	Run
				Geometric Mean			238												
Kosciusko 1	LMJ200-0005	Turkey Creek	Public Fishing Site, Syracuse East of SR 13,	9/27/00	8:25 AM	AA02034	32.7	Clear	0	14.98	8.48	352	9.18	95.6	Clear	46-60	West	Moderate	Lake
				10/3/00	3:35 PM	AA02186	9.7	Clear	0	19.66	8.09	357	8.65	97.6	Scattered	61-75	East	Light	Lake
				10/12/00	8:30 AM	AA02589	5.2	Clear	0.5	12.36	8.24	349	9.88	93.7	Clear	46-60	West	Light	Lake
				10/18/00	8:30 AM	AA02846	25.9	Clear	1	13.3	8.35	344	10.04	98.3	Clear	33-45	North	Light	Lake
				10/25/00	8:20 AM	AA02981	34.5	Clear	2	16.1	8.21	363	9.26	95	Cloudy	61-75	North	Calm	Lake
				Geometric Mean			17												
Kosciusko 2	LMJ200-0006	Wawasee Lake	CR 1000 N, DNR Fishing Pier	9/27/00	8:50 AM	AA02037	15.8	Clear	0	15.7	8.34	370	8.96	93.3	Clear	46-60	West	Moderate	Lake
				10/3/00	4:05 PM	AA02189	4.1	Clear	0	19.58	8.1	370	9.04	101.9	Scattered	76-85	East	Light	Lake
				10/12/00	8:50 AM	AA02592	4.1	Clear	1	12.52	8.12	369	9.46	90.4	Clear	46-60	West	Light	Lake
				10/18/00	9:00 AM	AA02847	9.7	Clear	1.2	13.81	8.11	389	9.28	91.8	Clear	46-60	North	Calm	Lake
				10/25/00	8:40 AM	AA02982	2	Clear	0	15.82	8.12	380	9.36	95.6	Cloudy	61-75	North	Calm	Lake
				Geometric Mean			6												

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Water Quality Data for Selected Sites in the Lake Michigan and Lake Erie Watersheds, June-October, 2000

County	IDEM Site ID	Stream Name	Location Description	Sample Date	Sample Time	Sample Number	E coli/100 mL	Water Color	Turbidity ntu's	Water Temp C°	pH	Spec Cond µohms/cm	DO mg/L	DO % Sat	Sky Cond	Air Temp F°	Wind Dir	Wind Spd	Flow Type
Kosciusko 3	LMJ200-0007	Dewart Lake	DNR boat ramp, East of CR 300 E	9/25/00	4:20 PM	AA02038	30.3	Clear	0.2	14.32	7.86	345	7.97	80.1	Cloudy	46-60	North	Mod./Light	Lake
				10/2/00	3:45 PM	AA02190	18.65	Brown	1.4	19.28	7.62	362	7.71	89.1	Cloudy	76-85	South	Calm	Lake
				10/10/00	3:45 PM	AA02561	5.2	Clear	1	11.52	7.64	345	10.64	9.5	Clear	61-75	West	Mod./Strong	Lake
				10/16/00	3:30 PM	AA02818	1	Clear	2.4	17.16	7.67	363	7.07	74.9	Cloudy	61-75	East	Light	Lake
				10/23/00	3:00 PM	AA02956	4.1	Clear	0.5	16.76	7.5	397	6.45	67.7	Cloudy	61-75	North	Calm	Lake
				Geometric Mean			7												
Kosciusko 4	LMJ200-0013	Turkey Creek	SR 15 bridge in Millford	9/25/00	5:00 PM	AA02039	488.4	Clear	0	12.25	8.1	711	9.72	93.4	Cloudy	61-75	North	Moderate	Run
				10/2/00	4:13 PM	AA02192	328.2	Clear	0	18.2	7.91	755	8.9	98.4	Ptly Cloudy	76-85	West	Light	Run
				10/10/00	4:10 PM	AA02564	461.1	Clear	2	11.77	7.91	721	10.41	98.5	Clear	61-75	West	Moderate	Riffle
				10/16/00	3:40 PM	AA02820	307.6	Clear	1	15.11	8.08	689	9.82	99.5	Cloudy	61-75	East	Light	Run
				10/23/00	3:25 PM	AA02959	131.7	Clear	0.2	15.44	7.81	692	9.3	95	Cloudy	61-75	North	Calm	Riffle
				Geometric Mean			313												

APPENDIX B

Water Quality Data Comparing Turbidity and E. coli Concentrations In the Lake Michigan and Lake Erie Watersheds, June-October, 2000

	Table X Samples reported as greater than 2419.2, or TNTC					Page 1 of 1	
	43 cases sorted by turbidity measurements				9.4% of all tests		
	Test 1 = E.coli1>2419.17,TNTC			Test 2 =E. Coli2=<2419.17, OK			
	E coli 1 is the result of 100 mL sample volume			E coli 2 is the result of 10 mL sample volume			
				1 is default , no dilution made			
	Date	Turbidity	E. Coli1	E. Coli2	Test 1	TEST 2	
1	9/25/00	0.6	2419.2	1	TNTC	OK	
2	9/26/00	1.1	2419.2	1	TNTC	OK	
3	6/20/00	1.2	2419.2	1	TNTC	OK	
4	10/24/00	1.6	2419.2	1	TNTC	OK	
5	6/20/00	2	2419.2	1	TNTC	OK	
6	10/3/00	2	2419.2	1	TNTC	OK	
7	10/4/00	2	2419.2	1	TNTC	OK	
8	10/3/00	2.2	2419.2	1	TNTC	OK	
9	10/4/00	2.3	2419.2	1	TNTC	OK	
10	9/27/00	3.1	2419.2	1	TNTC	OK	
11	8/22/00	4	2419.2	1	TNTC	OK	
12	10/4/00	4.2	2419.2	1	TNTC	OK	
13	10/4/00	4.2	2419.2	1	TNTC	OK	
14	10/4/00	4.3	2419.2	1	TNTC	OK	
15	7/11/00	5	2419.2	1	TNTC	OK	
16	10/4/00	5	2419.2	1	TNTC	OK	
17	10/24/00	7	2419.2	1	TNTC	OK	
18	7/10/00	10	2419.2	1	TNTC	OK	
19	6/13/00	11.1	2419.2	1	TNTC	OK	
20	7/31/00	17	2419.2	1	TNTC	OK	
21	7/4/00	18	2419.2	1	TNTC	OK	
22	8/8/00	18	2419.2	1	TNTC	OK	
23	8/14/00	22	2419.2	1	TNTC	OK	
24	6/13/00	26.3	2419.2	1	TNTC	OK	
25	6/13/00	26.7	2419.2	1	TNTC	OK	
26	8/1/00	34	2419.2	1	TNTC	OK	
27	6/14/00	36.6	2419.2	1	TNTC	OK	
28	8/1/00	44	2419.2	1	TNTC	OK	
29	6/19/00	44.8	2419.2	1	TNTC	OK	
30	8/1/00	48	2419.2	1	TNTC	OK	
31	6/12/00	55	2419.2	1	TNTC	OK	
32	8/1/00	60	2419.2	1	TNTC	OK	
33	6/14/00	61	2419.2	1	TNTC	OK	
34	6/13/00	63	2419.2	1	TNTC	OK	
35	7/5/00	71	2419.2	1	TNTC	OK	
36	6/12/00	77	2419.2	1	TNTC	OK	
37	6/13/00	85.2	2419.2	1	TNTC	OK	
38	6/12/00	96.2	2419.2	1	TNTC	OK	
39	6/19/00	99	2419.2	1	TNTC	OK	
40	6/13/00	99.9	2419.2	1	TNTC	OK	
41	6/12/00	109	2419.2	1	TNTC	OK	
42	6/19/00	116	2419.2	1	TNTC	OK	
43	6/19/00	184	2419.2	1	TNTC	OK	

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Water Quality Data Comparing Turbidity and E. coli Concentrations In the Lake Michigan and Lake Erie Watersheds, June-October, 2000

Table Y Samples tested with 100 mL and 10mL sample volumes												Page 1 of 1			
				99 cases divided into 2 groups				21.7% of all tests							
	38 cases where the 100 ml volume produced results sorted by Turbidity						61 cases where the 10 ml volume produced results sorted by Turbidity								
	EColi1 is the result of 100 mL sample volume						E coli2 is the result of 10 mL sample volume								
								1 is default , no dilution made							
	Date	Turbidity	EColi1	EColi2	Test 1	Test2		Date	Turbidity	EColi1	EColi2	Test 1	TEST 2		
1	6/28/00	0.9	1732.87	1086	OK	OK	12	7/25/00	25	2419.2	3654	TNTC	TNTC		
2	10/24/00	1	517.2	432	OK	OK	13	7/10/00	27	2419.2	256	TNTC	OK		
3	10/24/00	1	1203.3	1918	OK	OK	14	6/19/00	27	2419.2	1789	TNTC	OK		
4	7/11/00	2	727	538	OK	OK	15	7/10/00	28	2419.2	426	TNTC	OK		
5	7/25/00	3	107.6	161	OK	OK	16	7/3/00	28	2419.2	24192	TNTC	TNTC		
6	10/12/00	3	1732.87	1333	OK	OK	17	7/10/00	36	2419.2	331	TNTC	OK		
7	7/25/00	4	9.7	20	OK	OK	18	7/5/00	41	2419.2	2382	TNTC	OK		
8	8/21/00	4	770.1	520	OK	OK	19	6/19/00	42	2419.2	1137	TNTC	OK		
9	7/4/00	7	488.4	359	OK	OK	20	7/10/00	43	2419.2	556	TNTC	OK		
10	10/18/00	7	613.1	663	OK	OK	21	7/3/00	43	2419.2	24192	TNTC	TNTC		
11	7/12/00	7	816.4	601	OK	OK	22	6/21/00	43.2	2419.2	1071	TNTC	OK		
12	8/8/00	7	1732.87	1112	OK	OK	23	7/25/00	45	2419.2	3654	TNTC	TNTC		
13	8/8/00	8	1299.65	906	OK	OK	24	7/3/00	47	2419.2	987	TNTC	OK		
14	6/28/00	8.5	920.8	911	OK	OK	25	6/27/00	52.7	2419.2	24192	TNTC	TNTC		
15	6/28/00	9	206.3	262	OK	OK	26	6/20/00	65	2419.2	426	TNTC	OK		
16	8/15/00	10	90.6	74	OK	OK	27	6/28/00	71.7	2419.2	882	TNTC	OK		
17	7/11/00	10	613.1	457	OK	OK	28	6/19/00	75	2419.2	1317	TNTC	OK		
18	8/8/00	11	1553.07	882	OK	OK	29	6/21/00	76	2419.2	1076	TNTC	OK		
19	7/25/00	12	261.3	259	OK	OK	30	6/28/00	78.2	2419.2	794	TNTC	OK		
20	8/8/00	13	1119.85	749	OK	OK	31	6/21/00	80	2419.2	3130	TNTC	TNTC		
21	6/29/00	14.8	13.4	743	OK	OK	32	6/21/00	84	2419.2	12996	TNTC	TNTC		
22	6/29/00	15	547.5	471	OK	OK	33	6/21/00	84	2419.2	24192	TNTC	TNTC		
23	8/15/00	18	201.4	233	OK	OK	34	7/4/00	85	2419.2	3654	TNTC	TNTC		
24	6/28/00	18	435.2	309	OK	OK	35	7/5/00	85	2419.2	4611	TNTC	TNTC		
25	6/29/00	19	191.8	262	OK	OK	36	6/19/00	92	2419.2	1396	TNTC	OK		
26	7/25/00	21	28.7	84	OK	OK	37	6/20/00	94.6	2419.2	1439	TNTC	OK		
27	7/25/00	21	517.2	426	OK	OK	38	6/21/00	95	2419.2	3448	TNTC	TNTC		
28	6/29/00	24	435.2	201	OK	OK	39	6/19/00	97	2419.2	1515	TNTC	OK		
29	7/12/00	27	816	657	OK	OK	40	7/3/00	97	2419.2	3130	TNTC	TNTC		
30	7/11/00	28	74.3	161	OK	OK	41	6/27/00	102	2419.2	14136	TNTC	TNTC		
31	7/11/00	32.5	1553.07	1935	OK	OK	42	6/27/00	107	2419.2	1989	TNTC	OK		
32	7/4/00	34	517.2	504	OK	OK	43	6/20/00	117	2419.2	805	TNTC	OK		
33	7/4/00	38	1299.65	1414	OK	OK	44	6/27/00	129	2419.2	703	TNTC	OK		
34	7/11/00	40.4	238.2	309	OK	OK	45	6/21/00	130	2419.2	5794	TNTC	TNTC		
35	6/29/00	41.2	365.4	231	OK	OK	46	8/7/00	148	2419.2	8164	TNTC	TNTC		
36	10/18/00	42	344.8	323	OK	OK	47	6/28/00	155	2419.2	1467	TNTC	OK		
37	7/11/00	51	172.3	110	OK	OK	48	6/27/00	157	2419.2	884	TNTC	OK		
38	6/29/00	54.5	378.4	275	OK	OK	49	6/21/00	165	2419.2	7701	TNTC	TNTC		
1	10/24/00	2	2419.2	2909	TNTC	TNTC	50	6/21/00	171	2419.2	17329	TNTC	TNTC		
2	6/20/00	4	2419.2	228	TNTC	OK	51	7/4/00	187	2419.2	5172	TNTC	TNTC		
3	7/4/00	5	2419.2	4352	TNTC	TNTC	52	6/27/00	191	2419.2	1178	TNTC	OK		
4	7/24/00	7	2419.2	4352	TNTC	TNTC	53	6/28/00	205	2419.2	14136	TNTC	TNTC		
5	6/20/00	7.7	2419.2	298	TNTC	OK	54	7/3/00	238	2419.2	14136	TNTC	TNTC		
6	6/20/00	12.6	2419.2	364	TNTC	OK	55	7/3/00	305	2419.2	24192	TNTC	TNTC		
7	8/21/00	14	2419.2	5475	TNTC	TNTC	56	7/3/00	389	2419.2	24191	TNTC	TNTC		
8	6/28/00	17	2419.2	538	TNTC	OK	57	7/3/00	411	2419.2	24192	TNTC	TNTC		
9	8/21/00	18	2419.2	8164	TNTC	TNTC	58	7/3/00	736	2419.2	19863	TNTC	TNTC		
10	7/5/00	21	2419.2	1374	TNTC	OK	59	7/3/00	934	2419.2	24191	TNTC	TNTC		
11	6/29/00	24	2419.2	7270	TNTC	TNTC	60	7/3/00	950	2419.2	24192	TNTC	TNTC		
12	7/10/00	25	2419.2	723	TNTC	OK									

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Water Quality Data Comparing Turbidity and E. coli Concentrations In the Lake Michigan and Lake Erie Watersheds, June-October, 2000

	Table Z 456 samples sorted by Turbidity											Page1 of 5		
	82 cases where the Turbidity was >/= 40 NTU						Sorted by EColi1 Results							
	E coli 1 is the result of 100 mL sample volume			E coli 2 is the result of 10 mL sample volume										
				1 is default , no dilution made										
	Date	Turbidity	EColi1	EColi2	Test 1	TEST 2	Date	Turbidity	EColi1	EColi2	Test 1	TEST 2		
1	8/21/00	42	107.6	1	OK	OK	6/27/00	129	2419	703	TNTC	OK		
2	7/12/00	55	146.7	1	OK	OK	6/28/00	78.2	2419	794	TNTC	OK		
3	7/12/00	40	156.5	1	OK	OK	6/20/00	117	2419	805	TNTC	OK		
4	7/11/00	51	172.3	110	OK	OK	6/28/00	71.7	2419	882	TNTC	OK		
5	7/11/00	40.4	238.2	309	OK	OK	6/27/00	157	2419	884	TNTC	OK		
6	6/27/00	169	307.6	1	OK	OK	7/3/00	47	2419	987	TNTC	OK		
7	10/18/00	42	344.8	323	OK	OK	6/21/00	43.2	2419	1071	TNTC	OK		
8	6/29/00	41.2	365.4	231	OK	OK	6/21/00	76	2419	1076	TNTC	OK		
9	6/29/00	54.5	378.4	275	OK	OK	6/19/00	42	2419	1137	TNTC	OK		
10	6/13/00	59	387.3	1	OK	OK	6/27/00	191	2419	1178	TNTC	OK		
11	7/24/00	44	488.4	1	OK	OK	6/19/00	75	2419	1317	TNTC	OK		
12	6/29/00	52.9	488.4	1	OK	OK	6/19/00	92	2419	1396	TNTC	OK		
13	6/14/00	121	488.4	1	OK	OK	6/20/00	94.6	2419	1439	TNTC	OK		
14	6/20/00	76	613	1	OK	OK	6/28/00	155	2419	1467	TNTC	OK		
15	7/5/00	95	816.4	1	OK	OK	6/19/00	97	2419	1515	TNTC	OK		
16	6/12/00	87.5	980.4	1	OK	OK	6/27/00	107	2419	1989	TNTC	OK		
17	6/12/00	60.2	1046.24	1	OK	OK	7/5/00	41	2419	2382	TNTC	OK		
18	6/27/00	47.8	1553.07	1	OK	OK	6/21/00	80	2419	3130	TNTC	TNTC		
19	6/12/00	58	1553.07	1	OK	OK	7/3/00	97	2419	3130	TNTC	TNTC		
20	6/14/00	50.8	1732.87	1	OK	OK	6/21/00	95	2419	3448	TNTC	TNTC		
21	6/14/00	156	1732.87	1	OK	OK	7/25/00	45	2419	3654	TNTC	TNTC		
22	6/14/00	43.4	1986.28	1	OK	OK	7/4/00	85	2419	3654	TNTC	TNTC		
23	6/14/00	43	2419.17	1	OK	OK	7/5/00	85	2419	4611	TNTC	TNTC		
24	8/1/00	44	2419.2	1	TNTC	OK	7/4/00	187	2419	5172	TNTC	TNTC		
25	6/19/00	44.8	2419.2	1	TNTC	OK	6/21/00	130	2419	5794	TNTC	TNTC		
26	8/1/00	48	2419.2	1	TNTC	OK	6/21/00	165	2419	7701	TNTC	TNTC		
27	6/12/00	55	2419.2	1	TNTC	OK	8/7/00	148	2419	8164	TNTC	TNTC		
28	8/1/00	60	2419.2	1	TNTC	OK	6/21/00	84	2419	12996	TNTC	TNTC		
29	6/14/00	61	2419.2	1	TNTC	OK	6/27/00	102	2419	14136	TNTC	TNTC		
30	6/13/00	63	2419.2	1	TNTC	OK	6/28/00	205	2419	14136	TNTC	TNTC		
31	7/5/00	71	2419.2	1	TNTC	OK	7/3/00	238	2419	14136	TNTC	TNTC		
32	6/12/00	77	2419.2	1	TNTC	OK	6/21/00	171	2419	17329	TNTC	TNTC		
33	6/13/00	85.2	2419.2	1	TNTC	OK	7/3/00	736	2419	19863	TNTC	TNTC		
34	6/12/00	96.2	2419.2	1	TNTC	OK	7/3/00	389	2419	24191	TNTC	TNTC		
35	6/19/00	99	2419.2	1	TNTC	OK	7/3/00	934	2419	24191	TNTC	TNTC		
36	6/13/00	99.9	2419.2	1	TNTC	OK	7/3/00	43	2419	24192	TNTC	TNTC		
37	6/12/00	109	2419.2	1	TNTC	OK	6/27/00	52.7	2419	24192	TNTC	TNTC		
38	6/19/00	116	2419.2	1	TNTC	OK	6/21/00	84	2419	24192	TNTC	TNTC		
39	6/19/00	184	2419.2	1	TNTC	OK	7/3/00	305	2419	24192	TNTC	TNTC		
40	6/20/00	65	2419.2	426	TNTC	OK	7/3/00	411	2419	24192	TNTC	TNTC		
41	7/10/00	43	2419.2	556	TNTC	OK	7/3/00	950	2419	24192	TNTC	TNTC		

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	Table Z 456 samples sorted by Turbidity										Page 2 of 5		
	373 cases where the Turbidity was < 40 NTU						Sorted by EColi1Results						
	E coli 1 is the result of 100 mL sample volume			E coli 2 is the result of 10 mL sample volume									
				1 is default , no dilution made									
	Date	Turbidity	EColi1	EColi2	Test 1	Test2	Date	Turbidity	EColi1	EColi2	Test 1	Test2	
1	7/12/00	0.5	0	1	OK	OK	8/21/00	6	23.1	1	OK	OK	
2	6/29/00	0.8	0	1	OK	OK	8/15/00	3	23.8	1	OK	OK	
3	10/12/00	1.7	0	1	OK	OK	8/14/00	4	24	1	OK	OK	
4	10/16/00	2.4	0	1	OK	OK	9/26/00	0.9	24.9	1	OK	OK	
5	6/14/00	5.1	0	1	OK	OK	8/1/00	22	25	1	OK	OK	
6	9/27/00	1	1	1	OK	OK	10/18/00	1	25.9	1	OK	OK	
7	10/23/00	9	1	1	OK	OK	7/4/00	4	26.2	1	OK	OK	
8	10/25/00	0	2	1	OK	OK	6/28/00	1.5	26.9	1	OK	OK	
9	10/12/00	2	2	1	OK	OK	10/2/00	1.4	27.8	1	OK	OK	
10	8/22/00	3	2	1	OK	OK	7/25/00	21	28.7	84	OK	OK	
11	10/18/00	4	2	1	OK	OK	10/23/00	0	29.5	1	OK	OK	
12	7/5/00	5	2	1	OK	OK	8/15/00	18	30.1	1	OK	OK	
13	10/16/00	15	2	1	OK	OK	9/25/00	0.2	30.3	1	OK	OK	
14	10/10/00	20	2	1	OK	OK	10/17/00	5	30.5	1	OK	OK	
15	6/20/00	1.4	3.1	1	OK	OK	9/27/00	0	32.7	1	OK	OK	
16	9/26/00	14.5	3.1	1	OK	OK	10/11/00	2	32.7	1	OK	OK	
17	10/3/00	0	4.1	1	OK	OK	8/1/00	21	32.7	1	OK	OK	
18	10/23/00	0.5	4.1	1	OK	OK	6/20/00	4	33.2	1	OK	OK	
19	10/12/00	1	4.1	1	OK	OK	6/21/00	3.5	34.1	1	OK	OK	
20	10/12/00	0.5	5.2	1	OK	OK	10/17/00	1.1	34.5	1	OK	OK	
21	10/10/00	1	5.2	1	OK	OK	10/25/00	2	34.5	1	OK	OK	
22	6/21/00	1.8	5.2	1	OK	OK	10/11/00	3.7	37.4	1	OK	OK	
23	10/18/00	3	5.2	1	OK	OK	7/4/00	2	39.1	1	OK	OK	
24	10/25/00	3.5	5.2	1	OK	OK	10/11/00	1	40.8	1	OK	OK	
25	6/28/00	0.7	9.3	1	OK	OK	10/24/00	2	44.1	1	OK	OK	
26	10/3/00	0	9.7	1	OK	OK	10/2/00	0	45	1	OK	OK	
27	10/18/00	1.2	9.7	1	OK	OK	6/20/00	3	47.2	1	OK	OK	
28	7/25/00	4	9.7	20	OK	OK	9/26/00	0.6	48	1	OK	OK	
29	7/25/00	17	9.8	1	OK	OK	6/20/00	3.5	49.6	1	OK	OK	
30	10/25/00	2	10.8	1	OK	OK	7/24/00	8	49.6	1	OK	OK	
31	7/11/00	2	11	1	OK	OK	6/20/00	6	51.2	1	OK	OK	
32	7/12/00	6	11	1	OK	OK	10/23/00	0.5	52.1	1	OK	OK	
33	10/2/00	10	11	1	OK	OK	7/11/00	1	56.3	1	OK	OK	
34	7/11/00	10	12	1	OK	OK	10/10/00	1	57.3	1	OK	OK	
35	10/16/00	1	12.2	1	OK	OK	7/11/00	15	59.3	1	OK	OK	
36	10/11/00	2	12.2	1	OK	OK	9/26/00	0.3	60.5	1	OK	OK	
37	6/28/00	1.9	13.4	1	OK	OK	10/2/00	0.5	60.9	1	OK	OK	
38	8/22/00	14	13.4	1	OK	OK	10/16/00	1.5	63.8	1	OK	OK	
39	6/29/00	14.8	13.4	743	OK	OK	10/17/00	5.7	65	1	OK	OK	
40	9/27/00	0	15.8	1	OK	OK	10/23/00	3.3	66.9	1	OK	OK	
41	6/20/00	10	16	1	OK	OK	8/8/00	6	67	1	OK	OK	
42	10/3/00	0	16.1	1	OK	OK	7/11/00	13	68.9	1	OK	OK	
43	7/4/00	3	16.8	1	OK	OK	7/4/00	2	69.1	1	OK	OK	
44	10/5/00	0.5	17.3	1	OK	OK	10/10/00	1	71.2	1	OK	OK	
45	7/5/00	10	17.3	1	OK	OK	10/11/00	3	72.8	1	OK	OK	
46	6/14/00	9.7	18.9	1	OK	OK	7/11/00	28	74.3	161	OK	OK	
47	7/4/00	3	19.7	1	OK	OK	6/28/00	9.4	74.9	1	OK	OK	
48	10/17/00	2.4	19.9	1	OK	OK	6/20/00	3	75.4	1	OK	OK	
49	10/17/00	5	22.6	1	OK	OK	6/28/00	6.2	76.6	1	OK	OK	
50	7/24/00	6	22.8	1	OK	OK	10/24/00	0.5	77.6	1	OK	OK	

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	Table Z 456 samples sorted by Turbidity											Page 3 of 5	
373 cases where the Turbidity was < 40 NTU							Sorted by EColi1 Results						
	E coli 1 is the result of 100 mL sample volume			E coli 2 is the result of 10 mL sample volume									
				1 is default , no dilution made									
	Date	Turbidity	EColi1	EColi2	Test1	Test2		Date	Turbidity	EColi1	EColi2	Test 1	Test2
1	6/20/00	5	82	1	OK	OK		8/15/00	18	201.4	233	OK	OK
2	6/13/00	19.2	88	1	OK	OK		6/13/00	30.5	203.5	1	OK	OK
3	8/15/00	10	90.6	74	OK	OK		10/4/00	1	204.6	1	OK	OK
4	6/28/00	5	90.9	1	OK	OK		10/12/00	2	206.3	1	OK	OK
5	10/12/00	4	91.1	1	OK	OK		10/17/00	4.3	206.3	1	OK	OK
6	6/28/00	2.5	93.3	1	OK	OK		6/28/00	9	206.3	262	OK	OK
7	7/31/00	16	95.9	1	OK	OK		10/3/00	3	209.8	1	OK	OK
8	9/26/00	0.5	96	1	OK	OK		7/25/00	5	209.8	1	OK	OK
9	10/11/00	3.6	98.7	1	OK	OK		8/15/00	8	218.7	1	OK	OK
10	9/26/00	0.8	101	1	OK	OK		10/24/00	1	224.7	1	OK	OK
11	8/14/00	31	101.7	1	OK	OK		10/16/00	5.5	235.9	1	OK	OK
12	7/10/00	6.1	103.9	1	OK	OK		10/2/00	1	238.2	1	OK	OK
13	7/25/00	3	107.6	161	OK	OK		8/8/00	9	248.1	1	OK	OK
14	10/12/00	5	108.6	1	OK	OK		10/11/00	1.5	248.9	1	OK	OK
15	10/3/00	2	110.6	1	OK	OK		8/15/00	6	260.2	1	OK	OK
16	8/22/00	6	110.6	1	OK	OK		9/26/00	4	261.3	1	OK	OK
17	7/11/00	1	111.9	1	OK	OK		8/15/00	13	261.3	1	OK	OK
18	9/27/00	0.6	116.9	1	OK	OK		7/25/00	12	261.3	259	OK	OK
19	10/25/00	6	117.8	1	OK	OK		7/24/00	18.9	270	1	OK	OK
20	6/28/00	4	119.8	1	OK	OK		9/27/00	3	272.3	1	OK	OK
21	8/22/00	8	124.6	1	OK	OK		10/11/00	3	272.3	1	OK	OK
22	8/7/00	11	129.1	1	OK	OK		6/20/00	28	272.3	1	OK	OK
23	7/4/00	2	129.6	1	OK	OK		7/25/00	3	285.1	1	OK	OK
24	7/11/00	5	129.6	1	OK	OK		9/25/00	0.5	290.9	1	OK	OK
25	10/23/00	0.2	131.7	1	OK	OK		10/3/00	0.6	290.9	1	OK	OK
26	10/23/00	2	131.7	1	OK	OK		10/16/00	1	307.6	1	OK	OK
27	9/26/00	3.4	131.7	1	OK	OK		10/23/00	4	325.5	1	OK	OK
28	7/4/00	5	131.9	1	OK	OK		10/18/00	4.9	325.5	1	OK	OK
29	10/18/00	8	135.4	1	OK	OK		8/22/00	5	325.5	1	OK	OK
30	10/12/00	14	135.4	1	OK	OK		8/22/00	5	325.5	1	OK	OK
31	6/13/00	12.9	137.4	1	OK	OK		8/22/00	5	325.5	1	OK	OK
32	10/3/00	0.2	141.4	1	OK	OK		8/22/00	5	325.5	1	OK	OK
33	7/25/00	7	141.4	1	OK	OK		9/27/00	7.7	325.5	1	OK	OK
34	6/13/00	11.5	142.1	1	OK	OK		10/25/00	9	325.5	1	OK	OK
35	10/18/00	3	143.9	1	OK	OK		8/1/00	13	325.5	1	OK	OK
36	10/10/00	11	155.3	1	OK	OK		7/5/00	37	325.5	1	OK	OK
37	10/3/00	7	160.7	1	OK	OK		10/2/00	0	328.2	1	OK	OK
38	10/25/00	1.5	163.1	1	OK	OK		9/26/00	4.1	344.8	1	OK	OK
39	7/11/00	2.4	166.4	1	OK	OK		8/22/00	5	344.8	1	OK	OK
40	10/3/00	4	166.4	1	OK	OK		7/25/00	10	344.8	1	OK	OK
41	8/22/00	5	166.9	1	OK	OK		8/22/00	10	344.8	1	OK	OK
42	8/14/00	8	166.9	1	OK	OK		7/12/00	24	344.8	1	OK	OK
43	7/11/00	5	172.3	1	OK	OK		10/3/00	2	365.4	1	OK	OK
44	6/13/00	27.1	172.3	1	OK	OK		7/31/00	6	365.4	1	OK	OK
45	8/21/00	6	178.5	1	OK	OK		10/3/00	0	387.3	1	OK	OK
46	6/13/00	11.2	178.9	1	OK	OK		7/25/00	6	387.3	1	OK	OK
47	10/11/00	2	185	1	OK	OK		7/11/00	15	387.3	1	OK	OK
48	8/15/00	5	186	1	OK	OK		7/24/00	18	387.3	1	OK	OK
49	7/12/00	8	186	1	OK	OK		8/22/00	23	387.3	1	OK	OK
50	6/29/00	19	191.8	262	OK	OK		8/22/00	27	387.3	1	OK	OK

APPENDIX B

Water Quality Data Comparing Turbidity and E. coli Concentrations In the Lake Michigan and Lake Erie Watersheds, June-October, 2000

	Table Z 456 samples sorted by Turbidity											Page 4 of 5	
	373 cases where the Turbidity was < 40 NTU							Sorted by EColi1 Results					
	E coli 1 is the result of 100 mL sample volume			E coli 2 is the result of 10 mL sample volume									
				1 is default , no dilution made									
	Date	Turbidity	EColi1	EColi2	Test 1	Test2		Date	Turbidity	EColi1	EColi2	Test 1	Test2
1	10/17/00	2	410.6	1	OK	OK		7/11/00	2	727	538	OK	OK
2	7/25/00	5	410.6	1	OK	OK		10/12/00	4	770.1	1	OK	OK
3	7/12/00	11	410.6	1	OK	OK		10/11/00	7	770.1	1	OK	OK
4	8/22/00	14	410.6	1	OK	OK		7/31/00	8	770.1	1	OK	OK
5	10/17/00	1.8	435.2	1	OK	OK		8/15/00	11	770.1	1	OK	OK
6	9/27/00	3.7	435.2	1	OK	OK		8/1/00	18	770.1	1	OK	OK
7	7/25/00	11	435.2	1	OK	OK		7/31/00	18	770.1	1	OK	OK
8	8/15/00	16	435.2	1	OK	OK		8/21/00	4	770.1	520	OK	OK
9	8/15/00	18	435.2	1	OK	OK		7/12/00	27	816	657	OK	OK
10	6/13/00	29	435.2	1	OK	OK		10/17/00	5	816.4	1	OK	OK
11	6/29/00	24	435.2	201	OK	OK		8/1/00	8	816.4	1	OK	OK
12	6/28/00	18	435.2	309	OK	OK		6/29/00	11.5	816.4	1	OK	OK
13	9/26/00	2	461.1	1	OK	OK		7/25/00	13	816.4	1	OK	OK
14	10/10/00	2	461.1	1	OK	OK		8/22/00	18	816.4	1	OK	OK
15	8/8/00	7	461.1	1	OK	OK		8/21/00	20	816.4	1	OK	OK
16	8/15/00	7	461.1	1	OK	OK		7/12/00	7	816.4	601	OK	OK
17	8/15/00	8	461.1	1	OK	OK		10/4/00	4.1	866.4	1	OK	OK
18	8/1/00	11	461.1	1	OK	OK		7/25/00	10	866.4	1	OK	OK
19	7/10/00	25	461.1	1	OK	OK		6/12/00	13.6	866.4	1	OK	OK
20	9/25/00	0	488.4	1	OK	OK		10/23/00	1	920.8	1	OK	OK
21	8/14/00	5	488.4	1	OK	OK		6/28/00	2.5	920.8	1	OK	OK
22	6/13/00	11.5	488.4	1	OK	OK		7/4/00	4	920.8	1	OK	OK
23	8/8/00	20	488.4	1	OK	OK		8/8/00	6	920.8	1	OK	OK
24	7/4/00	7	488.4	359	OK	OK		8/1/00	8	920.8	1	OK	OK
25	8/22/00	4	517.2	1	OK	OK		8/1/00	13	920.8	1	OK	OK
26	7/25/00	21	517.2	426	OK	OK		8/1/00	13	920.8	1	OK	OK
27	10/24/00	1	517.2	432	OK	OK		8/1/00	25	920.8	1	OK	OK
28	7/4/00	34	517.2	504	OK	OK		8/7/00	36	920.8	1	OK	OK
29	9/26/00	0.8	547.5	1	OK	OK		6/28/00	8.5	920.8	911	OK	OK
30	8/15/00	3	547.5	1	OK	OK		6/13/00	18.9	980	1	OK	OK
31	8/15/00	6	547.5	1	OK	OK		8/1/00	28	980.4	1	OK	OK
32	6/29/00	15	547.5	471	OK	OK		7/11/00	3	1046	1	OK	OK
33	10/25/00	3	613.1	1	OK	OK		7/31/00	24	1046	1	OK	OK
34	7/11/00	10	613.1	457	OK	OK		10/10/00	2	1120	1	OK	OK
35	10/18/00	7	613.1	663	OK	OK		10/16/00	6.5	1120	1	OK	OK
36	10/24/00	1	648.8	1	OK	OK		7/10/00	10	1120	1	OK	OK
37	9/26/00	1.8	648.8	1	OK	OK		8/8/00	14	1120	1	OK	OK
38	7/12/00	5	648.8	1	OK	OK		8/8/00	13	1120	749	OK	OK
39	7/25/00	7	648.8	1	OK	OK		7/31/00	33	1203	1	OK	OK
40	8/1/00	16	648.8	1	OK	OK		10/24/00	1	1203	1918	OK	OK
41	8/1/00	17	648.8	1	OK	OK		9/27/00	6.9	1203	1	OK	OK
42	10/16/00	2.2	686.7	1	OK	OK		8/8/00	13	1203	1	OK	OK
43	8/15/00	6	686.7	1	OK	OK		7/5/00	17	1203	1	OK	OK
44	8/8/00	7	686.7	1	OK	OK		6/14/00	34.2	1203	1	OK	OK
45	8/7/00	10	686.7	1	OK	OK		9/26/00	0.3	1300	1	OK	OK
46	6/29/00	13.2	686.7	1	OK	OK		10/17/00	2.2	1300	1	OK	OK
47	10/26/00	4	687.7	1	OK	OK		8/14/00	13	1300	1	OK	OK
48	10/11/00	1	688.7	1	OK	OK		8/8/00	8	1300	906	OK	OK
49	10/17/00	1.2	727	1	OK	OK		7/4/00	38	1300	1414	OK	OK
50	7/12/00	5	727	1	OK	OK		10/11/00	2	1414	1	OK	OK

APPENDIX B

Water Quality Data Comparing Turbidity and E. coli Concentrations In the Lake Michigan and Lake Erie Watersheds, June-October, 2000

Table Z 456 samples sorted by Turbidity											Page 5 of 5			
		373 cases where the Turbidity was < 40 NTU						Sorted by EColi1 Results						
	E coli 1 is the result of 100 mL sample volume			E coli 2 is the result of 10 mL sample volume										
				1 is default , no dilution made										
	Date	Turbidity	EColi1	EColi2	Test 1	Test2		Date	Turbidity	EColi1	EColi2	Test 1	Test2	
1	8/14/00	7	1413.6	1	OK	OK		8/14/00	22	2419.2	1	TNTC	OK	
2	8/7/00	31	1413.6	1	OK	OK		6/13/00	26.3	2419.2	1	TNTC	OK	
3	10/2/00	0.4	1553	1	OK	OK		6/13/00	26.7	2419.2	1	TNTC	OK	
4	7/4/00	3	1553.07	1	OK	OK		8/1/00	34	2419.2	1	TNTC	OK	
5	6/13/00	11.7	1553.07	1	OK	OK		6/14/00	36.6	2419.2	1	TNTC	OK	
6	8/22/00	18	1553.07	1	OK	OK		6/20/00	4	2419.2	228	TNTC	OK	
7	8/8/00	11	1553.07	882	OK	OK		7/10/00	27	2419.2	256	TNTC	OK	
8	7/11/00	32.5	1553.07	1935	OK	OK		6/20/00	7.7	2419.2	298	TNTC	OK	
9	7/5/00	9	1732.87	1	OK	OK		7/10/00	36	2419.2	331	TNTC	OK	
10	8/8/00	14	1732.87	1	OK	OK		6/20/00	12.6	2419.2	364	TNTC	OK	
11	6/28/00	0.9	1732.87	1086	OK	OK		7/10/00	28	2419.2	426	TNTC	OK	
12	8/8/00	7	1732.87	1112	OK	OK		6/28/00	17	2419.2	538	TNTC	OK	
13	10/12/00	3	1732.87	1333	OK	OK		7/10/00	25	2419.2	723	TNTC	OK	
14	10/18/00	0.3	1986.28	1	OK	OK		7/5/00	21	2419.2	1374	TNTC	OK	
15	7/11/00	12	1986.28	1	OK	OK		6/19/00	27	2419.2	1789	TNTC	OK	
16	8/21/00	22	1986.28	1	OK	OK		10/24/00	2	2419.2	2909	TNTC	TNTC	
17	7/12/00	24	1986.28	1	OK	OK		7/25/00	25	2419.2	3654	TNTC	TNTC	
18	7/12/00	24.4	1986.28	1	OK	OK		7/4/00	5	2419.2	4352	TNTC	TNTC	
19	6/28/00	32	1986.28	1	OK	OK		7/24/00	7	2419.2	4352	TNTC	TNTC	
20	8/8/00	1.3	2419.17	1	OK	OK		8/21/00	14	2419.2	5475	TNTC	TNTC	
21	10/24/00	4	2419.17	1	OK	OK		6/29/00	24	2419.2	7270	TNTC	TNTC	
22	8/8/00	11	2419.17	1	OK	OK		8/21/00	18	2419.2	8164	TNTC	TNTC	
23	7/4/00	13	2419.17	1	OK	OK		7/3/00	28	2419.2	24192	TNTC	TNTC	
24	8/8/00	14	2419.17	1	OK	OK								
25	7/11/00	19.4	2419.17	1	OK	OK								
26	6/28/00	22	2419.17	1	OK	OK								
27	8/8/00	22	2419.17	1	OK	OK								
28	10/12/00	37	2419.17	1	OK	OK								
29	9/25/00	0.6	2419.2	1	TNTC	OK								
30	9/26/00	1.1	2419.2	1	TNTC	OK								
31	6/20/00	1.2	2419.2	1	TNTC	OK								
32	10/24/00	1.6	2419.2	1	TNTC	OK								
33	6/20/00	2	2419.2	1	TNTC	OK								
34	10/3/00	2	2419.2	1	TNTC	OK								
35	10/4/00	2	2419.2	1	TNTC	OK								
36	10/3/00	2.2	2419.2	1	TNTC	OK								
37	10/4/00	2.3	2419.2	1	TNTC	OK								
38	9/27/00	3.1	2419.2	1	TNTC	OK								
39	8/22/00	4	2419.2	1	TNTC	OK								
40	10/4/00	4.2	2419.2	1	TNTC	OK								
41	10/4/00	4.2	2419.2	1	TNTC	OK								
42	10/4/00	4.3	2419.2	1	TNTC	OK								
43	7/11/00	5	2419.2	1	TNTC	OK								
44	10/4/00	5	2419.2	1	TNTC	OK								
45	10/24/00	7	2419.2	1	TNTC	OK								
46	7/10/00	10	2419.2	1	TNTC	OK								
47	6/13/00	11.1	2419.2	1	TNTC	OK								
48	7/31/00	17	2419.2	1	TNTC	OK								
49	7/4/00	18	2419.2	1	TNTC	OK								
50	8/8/00	18	2419.2	1	TNTC	OK								